Wage differentials and government corruption

Le, Van Ha

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A micro survey data approach

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Publisher: University of Groningen
Groningen, The Netherlands
Printer: Ipskamp Drukkers B.V.
Enschede, The Netherlands

ISBN: 978-90-367-6756-9 (book)
978-90-367-6757-6 (e-book)

rijksuniversiteit groningen

Wage Differentials and Government Corruption

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Proefschrift

ter verkrijging van het doctoraat aan de
Rijksuniversiteit Groningen
op gezag van de
rector magnificus, prof.dr. E. Sterken
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op

Donderdag 16 januari 2014 om 16.15 uur

door

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geboren op 18 januari 1983
te Thanh Hoa, Vietnam

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Con kính tặng bố mẹ, tặng em yêu và hai con

To my parents, my wife and my children

ACKOWLEDGEMENTS

An important conclusion of this thesis is that: "Increasing government wages may substantially reduce corruption in relatively poor countries. Also in these countries, corruptible bureaucrats discriminate firms according to their industry's average wage level in order to extract bribes. Firms in high-wage industries, therefore, face more red tape and spend more on corruption. Monitoring, detection and punishment of corruption should be focused on bureaucrats responsible for regulating high-wage industries". With the completion of this thesis, I could finally answer, at least partly, some of the questions that have been troubling many economists, including myself, about the relationship between government wages and corruption. To this end, I have gone a long journey during which I have become grateful to many people who have been so kind and generous in making my PhD life smoother than expected. I would like to take this opportunity to single out some persons who have been vital to the completion of my dissertation.

First and foremost, I would like to thank my supervisors, Prof. dr. Jakob de Haan and Prof. dr. Erik Dietzenbacher. Erik has been with me from the very beginning of my PhD project. When it became apparent that my research topic did not fit entirely into his field of expertise, Jakob was invited on board as my first supervisor. I still remember how happy I was the day I learnt that two of the finest professors would be my supervisors in the next almost four years. Jakob was always patient to my ideas and timely guided me through the refining process to turn those ideas into good research questions. Erik sometimes appeared to distance himself from my arguments and questions until I spelled out the gist of the story, thus making me reformulate the questions myself. With such different styles of guidance, both of you have lifted my research skills to a new high level. You both wanted me to grow up as a prudent researcher. Thank you very much for all your work, guidance and encouragement.

I would also like to thank Prof. dr. Steven Brakman and Dr. Dirk Bezemer for their generous guidance during the first months of my PhD project. Steven and Dirk departed when I chose the research topic on corruption and government wages, but their professionalism and their kindness were always present. My sincere thanks to the reading committee, Prof. dr. A. Jain, Prof. dr. M. Paldam and Prof. dr. A.E. Steenge, for spending time on reading my entire thesis and giving me useful comments. Dr. Linda Toolsema-Veldman and Dr. Martin Land have been excellent PhD coordinators. Like any PhD student, I would like to thank you both for having been so supportive to my research.

It would be no exaggeration to state that my PhD project would never have been realized without the help of Mrs. Rina Koning and Dr. Bart Los. Rina and Bart were the first people to open the door to the University of Groningen for me. I learnt about the Huygens Scholarship pretty late in December, 2006. Rushing to prepare the application documents, I only had the faintest hope of meeting the deadlines. Luckily, my dream became true thanks to the prompt responses and clear guidance from Bart and Rina. Next, Bart was very supportive in guiding me

through the Research Master program, a crucial step for me to embark on this PhD journey. My life would have taken a different path without your kindness. Thank you very much, Rina! Thank you very much, Bart!

My PhD project involves a great deal of work on data collection. I would never have succeeded in constructing the database without the generosity of many researchers and archive keepers around the world. I would like to take this opportunity to thank the SOM bureau for buying the necessary data for my project and the librarians at the FEB library who have been very supportive in getting and distributing the data. My special thanks to Leonardo Gasparini, David Jaume, Mariana Viollaz, Carolina García Domench, Darío Tortarolo, Pablo Glüzmann, Carolina Lopez, Malena Arcidiácono, Emmanuel Vazquez, Cecilia Parada from the Socio-Economic Database for Latin America and the Caribbean; Helena Schweiger from the European Bank for Reconstruction and Development; Cong Minh Nguyen and the Enterprise Survey Team from the World Bank; Hua Le Anh from the International Labor Organization; Namees Nabeel from the Economic Research Forum; Caroline de Tombeur from the Luxembourg Income Study database; and many other anonymous people who have responded to my requests without mentioning their names. I know that at this overwhelming moment, I may forget some people who have been vital to my success in building the database. Whether your name is mentioned or not, your kindness and generosity will give me the motivation to help other people whenever I have the chance.

My research has been benefited from the discussions with colleagues from the faculty and especially my colleagues on the fifth floor. Prof. dr. Marcel Timmer and Prof. dr. Tom Wansbeek have given me precious comments. I really appreciate the meetings with the Political Economy Group, in which I had the chance to present my research to Jakob, Richard Jong-A-Pin, Jochen Mireau and my fellow PhD students, Hana, Shu, Hengki, Rasmus and Yanping. I must say that the meetings have been very helpful for me to complete my thesis during the last months of the project. My discussions with Dut Vo Van, Addisu Lashitew and Xu Yan (which not only confined to the realm of economics) have made my life more beautiful, especially when my research just hit some seemingly non-surmountable obstacles. Besides, Xu Yan has always been a great office mate and I feel very lucky to have shared the office with you in most of my PhD life. The Gemmies (GEM secretariat) and the SOM secretariat were supportive and professional and therefore also deserve my sincere thanks.

My PhD life has also been endowed with so many good friends. I would like to thank Umar Zaghum and Tristan Kohl for the comradeship that we share. I would also like to thank the Vietnamese student community in Groningen, which has been with me and my family in the last years. Special thanks to the student-families Cuong-Anh & Tom, Trung-Hong & En, Thuan-Tam & Khoi, Tuan Anh-Tinh & Nam Anh, Duong Thu Hong Nguyen & Be Mai, Dat-Nhung & Tung Duong, The Anh - Maria. You all have made my life a lot easier and sweeter.

It will never be enough, but I would like to thank my parents, my sisters, nieces and nephews who have always stood by me. And to my small family, I would like to dedicate all my love, my heart and soul. Millions of thanks to my wife who *"gives me faith cuz she believes I'm everything I am"*. My daughter Tuong Van and my son Tuong Thuy have made my PhD life a lot busier with love, care and laugh. They light up my life!

Hanoi
December 2013

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Chapter 1
Introduction

Many developing countries have very poorly paid civil servants. Although at independence most former colonies inherited civil service pay scales that exceeded private sector wages, this advantage has eroded over time. Wages relative to private sector wages have fallen in countries in transition in Eastern Europe and the former Soviet Union. The pattern varies across countries and over time. In some parts of the developing world public sector pay is so low that officials must supplement their pay with second jobs or payoffs.

Rose-Ackerman (2004, pp. 72-73).

1.1 Introduction

Starting with the pioneering studies of Leff (1964) and Rose-Ackerman (1975), the literature on corruption has grown exponentially in the last 40 years. Also the attention for corruption of policymakers and the general public has increased. At the moment of drafting this introduction, a search using "corruption" as keyword in Google gave about 135 million results. The same search in the Web of Knowledge database resulted in 1,186 articles in political science, 348 articles in law, and 416 articles in international relations. When the Econlit database was employed, the search resulted in 7,220 academic studies out of which 2,032 articles contain the word "corruption" in the title. These simple statistics suffice to highlight that corruption is an important subject not only to economists but also to other social scientists as well as policymakers and the general public.

Research on corruption in economics has gone through several stages. In the early days, corruption was viewed as a principal/agent problem and authors focused on a positive analysis of the mechanisms that cause the problem (Rose-Ackerman, 1978). Some authors argue that corruption is bad and suggest correction measures (Rose-Ackerman, 1975) while others express a more tolerant view, arguing that corruption may not be necessarily inconsistent with economic development.

However, when economic development became an important policy concern, corruption was regarded as one of the most severe obstacles for growth (Bardhan, 2006). Research on corruption has been burgeoning since then. The problem has been studied extensively from both theoretical and empirical perspectives. New insights into the causes and the consequences of the problem have been uncovered. Many factors have been identified as determinants of corruption and the consequences of corruption to socio-economic development are better understood now. More than 70 factors have been suggested as potential causes of corruption (Aidt, 2011). These factors can be classified into major groups such as economic factors, political factors, institutional factors, and geographical and cultural factors (Seldadyo and de Haan, 2006).

However, these factors should be viewed as belonging to only two groups. The first group comprises factors that are constant or rigid, such as distance to trade routes, colonial history, or religious fractions. The second group refers to factors that are within the capacity of the government to change. Typical examples in this group are trade policies, competition policies, and government transparency. While it is interesting and important to uncover the underlying factors that determine the level of corruption between countries or even between subnational units, it is more important for the process of socio-economic development that economists attach more weight to the second group of factors. Such research may shed light on mechanisms that impact corruption. Understanding these mechanisms may help to device policy suggestions that can bring low-income countries out of the vicious circle of rampant corruption and stagnant economic outcomes.

This thesis contributes to the literature by studying the impact of government remuneration policies on corruption. The topic has been investigated in a large number of studies over the past decades (Becker and Stigler, 1974; Besley and McLaren, 1993; Bond, 2008; Bose, 2004; Brunetti and Weder, 2003; Dutt, 2009; Herzfeld and Weiss, 2003; Macchiavello, 2008; Pellegrini and Gerlagh, 2008; Treisman, 2000, 2007; UlHaque and Sahay, 1996; Van Rijckeghem and Weder, 2001). Government wages can be raised by the government. Still, governments in most countries are reluctant to use this option to combat corruption, possibly because academic research has so far failed to generate any conclusive evidence on the effectiveness of this instrument. This thesis aims at bridging this gap.

Fighting corruption is difficult and very few anticorruption campaigns appear to be successful, leading several authors to conclude that corruption is persistent (Dawid and Feichtinger, 1996; Mauro, 2004). However, empirical evidence in the last 30 years shows that corruption converges in the long run. That is, many corrupt countries became ‘cleaner’ between 1984 and 2008, while many ‘clean’ countries became more corrupted (Seldadyo and de Haan, 2011). At the same time, several theoretical studies suggest that higher government wages are the key to the success of anticorruption reforms (Bond, 2008; Bose, 2004). It is, therefore, important for the process of socio-economic development that the relationship between government wages and corruption is addressed in a comprehensive manner.

1.2 Problem statement

1.2.1 What is corruption?

Corruption is defined as “the abuse of public office for private gains” (Rose-Ackerman, 2004) or “an act in which the power of public office is used for personal gain in a manner that contravenes the rules of the game” (Jain, 2001). Corruption as the “abuse of public office for private gain” is often equated with bribery which occurs when government employees—with a certain discretionary power to distribute scarce public goods to or impose some costly regulations on other agents—ask payments for some favors. However, corruption also encompasses a wide range of other illegal misconducts such as embezzlement (stealing of public funds), fraud (abusing the public office to deceive other people to gain money), self-dealing (abusing the public office to organize transactions to benefit oneself), favoritism (the practice of giving unfair preferential treatment to one

person or group at the expense of another) and nepotism (favors granted to relatives) (Morris, 2011).

1.2.2 Why is corruption bad for socio-economic development?

It is quite straightforward to show that most forms of corruption, such as embezzlement, fraud and self-dealing, have bad effects on economic development. However, the story about bribery is more complicated. Some authors, including Leff (1964) and Lui (1985), argue that bribery is the second-best solution to the problem of over-regulation. Law enforcers who accept bribes and turn a blind eye to black markets and smuggling might improve social welfare in case of excessive government regulation. Similarly, bribery introduces competition to the monopolistic government sector and brings firms most willing to pay, which are arguably the most efficient ones, ahead of a slow queue of firms not willing (or not able) to pay.

However, the argument that bribery enhances social welfare is highly problematic (Rose-Ackerman, 2004). First, bribe-prices are secret and entry to bribes may be blocked. Therefore, corrupt markets are not efficient. Second, the basic purposes of some public programs (such as social housing, pro-poor finance and disaster reliefs) would be violated by sales to the highest bidders. Third, profit-maximizing firms and individuals will not distinguish between socially efficient and socially inefficient rules. If corruption is allowed, they will want to be exempted from all rules and regulations. Finally, bribery breeds further bribery. Government employees have incentives to make government service artificially scarcer and government regulation artificially more burdensome to extract further bribes (Banerjee, 1997; Bose, 2004; Guriev, 2004).

Over the past decades, a large number of studies have examined the nexus between corruption and development. Corruption is found to lower economic growth either directly (Mauro, 1995; Swaleheen, 2011) or indirectly via lowering the incentives for productive investments (Johnson et al., 2011). Corruption engenders unsustainable economic developments (Aidt, 2009) and erodes public confidence in government institutions (Clausen et al., 2011). Corruption can also cause budget consolidation efforts to fail (Arin et al., 2011).

Most importantly, corruption sustains further corrupt activities because the public becomes indifferent to the problem (Mauro, 2004) while every new generation of bureaucrats becomes corrupt because their past and current colleagues and seniors are also corrupt (Dong et al., 2012; Sah, 2007). Selfish agents will also queue up for government jobs because it is easier to make money by becoming a bureaucrat than by making productive investments (Acemoglu and Verdier, 2000). Many developing countries seem to be entrapped in a bad equilibrium of rampant corruption, poverty and stagnation. Consequently, fighting corruption has been on top of the policy agenda of policymakers.

1.2.3 Theory

Raising government wages to combat corruption seems an intuitive solution because it lessens the bureaucrats' incentive to extract illegal income. Several studies therefore have suggested to pay higher government wages so as to break the vicious circle of corruption and poverty (Becker and Stigler, 1974; Bond, 2008; Bose, 2004; UlHaque and Sahay, 1996; Van Rijckeghem and Weder, 2001).

First, higher government wages deter corruption via two mechanisms: raising the cost of corruption and increasing the probability of detection (Becker and Stigler, 1974; Van Rijckeghem and Weder, 2001). When the probability that corruption is detected is high and the threat to lose a well-paid job is real, bureaucrats will avoid corruption because it is no longer an optimal choice when maximizing income.

Second, high government wages boost the dignity of civil servants and encourage them to forgo corrupt activities, even when corruption is the optimal choice to maximize income (Van Rijckeghem and Weder, 2001). Arguably, people choose to work for the government because they want to serve society (Macchiavello, 2008). These civil servants might be tempted to engage in corruption to ensure sufficient income but each act of corruption is associated with some moral cost (Bond, 2008; UlHaque and Sahay, 1996). As a result, a proportion of the bureaucrats may forgo corruption opportunities as long as they are paid at a level perceived to be fair, even if the probability of corruption detection and punishment is low (Van Rijckeghem and Weder, 2001).

Third, a government pay rise may serve as an exogenous shock to a high-corruption equilibrium. High government wages attract better people to the bureaucracy and prevent the movement of qualified employees to the private sector (UlHaque and Sahay, 1996). The public also becomes more vigilant to the operation of the bureaucracy when government wages are high (Van Rijckeghem and Weder, 2001), putting more pressure on bureaucrats to forgo corruption themselves and to report corruption by others. Hence, even a modest raise in government wages can lead to a new equilibrium with less corruption.

In contrast, other studies argue that high government wages do not reduce corruption or may even lead to more corruption (Besley and McLaren, 1993; Chang and Lai, 2002; Macchiavello, 2008). In a highly corrupted environment where the probability of detection as well as the probability of getting punishment upon detection is very low, the threat of job loss is close to zero. In such a situation, higher government wages will not change the incentive structure faced by bureaucrats (Van Rijckeghem and Weder, 2001). Selfish agents will also queue up for government jobs because of the high income from wages plus the illegal income from corruption. Government remuneration policy may unintentionally end up attracting too many individuals with the wrong 'talent' to the bureaucracy (Aidt, 2003; Bond, 2008; Macchiavello, 2008). Highly paid but selfish bureaucrats may also use part of their wage package to bribe their seniors when they are detected (Chang and Lai, 2002). More severely, highly paid government jobs become a scarce good that can be rationed only to those who can mobilize sufficient finances to buy such jobs via bribing the recruiting officials. In return, new bureaucrats will try to corrupt even more to recover their initial investment (Qijun and Kahana, 2010).

1.2.4 Empirical Research

Given the inconclusiveness of theoretical studies on the relationship between government wages and corruption, one would be inclined to think that empirical studies have shed some light on the issue. However, empirical research on the relationship between government wages and corruption in the last 20 years yielded only conflicting results.

Van Rijckeghem and Weder (2001) find that an increase in government wages reduces corruption. Also Dutt (2009), Herzfeld and Weiss (2003) and Pellegrini and Gerlagh (2008) report a negative relationship between government wages and corruption, although the

results are often not robust to different econometric specifications. In contrast, the results of Ades and DiTella (1997), Panizza (2001) and Treisman (2000, 2007) suggest that there is no significant relationship between both variables while La Porta et al. (1999) even find that higher government wages are correlated with more corruption.

Most studies on the impact of government wages on corruption so far are based on datasets created in the 1990s, such as Schiavo-Campo et al. (1997) and Van Rijckeghem and Weder (1997). Schiavo-Campo et al. (1997) provide a cross sectional dataset covering about 90 countries in the period between 1992 and 1995. Van Rijckeghem and Weder (1997) provide a panel dataset covering about 30 developing countries in the 1986-1994 period. For the construction, these authors followed Heller and Tait (1984). They use macro data to impute government wages (i.e. government wages were obtained from dividing the total government wage bill by total government employment). Only Panizza (2001) relies on micro data, using some 60 household surveys from 13 Latin American countries in the 1990s to estimate government wages.

Most empirical studies on the relationship between government wages and corruption are questionable due to the potential bias in the measurement of government wages. It is a common practice to impute government wages as the ratio of the government wage bill and total government employment (Afonso and Gomes, 2011; Gaetano, 2011; Heller and Tait, 1984; Lamo et al., 2012; Pérez and Sánchez, 2011; Schiavo-Campo et al., 1997; Van Rijckeghem and Weder, 2001). However, this macro data approach is potentially biased because of the measurement errors in the data for both the government wage bill and employment.

First, the government wage bill may not be recorded correctly (or inconsistently across time and space). A number of spending categories should be included in the government wage bill but they are often excluded (i.e. recorded somewhere else). For example, many non-monetary benefits—such as travel, housing and other allowances—can be recorded as spending under other goods and services. Payments to employees in government projects can also be recorded as capital spending while outlays for temporary workers are in some countries classified as use of goods and services (Clements et al., 2010).

Second, creating government employment data that are consistent over time and across countries is notoriously difficult. Issues to cope with include full time versus part time workers and full year versus part year employment. Some employees work full time for the whole year but others may work part time and only for a fraction of the year. In addition, casual workers—who work on contingent government projects—may account for a substantial proportion of government employment during some periods (Klitgaard, 1989). There is no agreed international standard on how to combine these different types of government employment into a single figure. In some developing countries, government employment is inflated by fictitious workers who only exist in the books (Clements et al., 2010).

The imputed average annual government wages can thus be biased upward or downward, depending on the precision of the statistics in a country. Most authors acknowledge that these limitations can render their results unreliable (Lamo et al., 2012; Schiavo-Campo, 1998; Van Rijckeghem and Weder, 2001). However, this top-down, macro data based approach is still being used frequently in the literature. The current controversy over the impact of government wages and corruption may partly be due to measurement errors.

1.3 Methodology

1.3.1 The research question

The research question in this thesis is twofold:

- First, how can a reliable dataset on government wages that covers a large number of countries over a reasonably long period be collected to facilitate further empirical research on the relationship between government wages and corruption?
- Second, what is the impact of government wages on corruption?

As the research questions indicate, this thesis will comprise of two parts. The first part deals with the problem of constructing and analyzing a database on government wages. The second part deals with the problem of modeling the empirical relationship between government wages and corruption.

1.3.2 Measuring government wages

Instead of following the literature to impute government wages from macro data, this thesis will employ a bottom-up, micro survey based approach to estimate government wages. Micro surveys are nationally representative and often conducted annually by the national statistics offices. They are one of the most important sources of information on socio-economic issues in both developed and developing countries. Micro survey data play an increasingly important role in social science research as well as in policy analyses. Virtually all countries have conducted surveys on income, work and labor force in one form or another. However, the potential of using survey data to study economic issues related to wages at aggregate levels is still largely neglected. Micro data open a new path to overcome the problem in most developing countries where data on the government wage bill and total government employment are lacking.

To construct a database on government wages, two types of data sources are employed. The first type includes national data archives and international micro databases, such as the World Bank Living Standard Measurement Survey or the Luxembourg Income Study. The agencies responsible for maintaining these databases and archives were contacted to obtain the original micro survey datasets (which have been collected by national statistics offices over the last 20 years and are available under certain conditions for academic research). From each dataset, all working persons who report a positive amount of wages and salaries in the reference period are classified in to one of the 17 one-digit industries classified according to the International Standard Industrial Classification of all Economic Activities, revision 3 (ISIC 3). The average wage in each industry is estimated as the weighted mean of wages of all persons working in that industry. The government wages are defined as the wages of workers in the Public administration, defense and compulsory social security industry. The questionnaires and the manuals are carefully consulted to make sure that only datasets of sufficiently good quality are retained.

The second type of data sources are the international databases that provide the estimated micro survey based average wages at the ISIC 3 one-digit level industries. Three databases belong to this category, namely the LABORSTA and ILOSTAT databases provided by the International Labor Organization (ILO), and the SEDLAC database provided by the Center for Distributional, Labor and Social Studies (CEDLAS) of the University of La Plata and

the World Bank's Latin America and the Caribbean Poverty and Gender Group (LCSPP). LABORSTA and ILOSTAT cover a large number of countries on a worldwide basis, while SEDLAC provides data for 25 countries in Latin America and the Caribbean. One drawback of these secondary databases is that many countries only report data which are based on a representative survey of the private sector. As result, the data on government wages are often missing.

In total, a worldwide database on wages for 126 countries over the late 1980s – 2011 period is collected. The database consists of 1,488 observations and provides data on wages for each of the 17 ISIC 3 industries as well as the total economy. From this database, a panel dataset of about 1,350 observations on government wages can be extracted, which will serve as the basis for the empirical studies on the relationship between government wages and corruption. The database will also be made publicly available online. The data may also facilitate further research on issues related to wages in (one of the) ISIC 3 one-digit industries.

We also use the micro-based government wages to examine the potential bias of macro-based government wages. The literature on survey methodology shows that estimates from micro household survey datasets are unbiased as long as the surveyed samples are random and representative (Lohr, 2010). A large body of survey validation literature indeed reports that household survey data yield unbiased estimates of the true wages (Akee, 2011; Bound et al., 2001). As the results in Chapter 2 will show, the macro-based government wages are biased for most countries that have data of sufficiently good quality. The sign and size of the bias are country-specific and remain relatively stable over time.

1.3.3 Modeling the relationship between government wages and corruption

With the availability of the new, worldwide panel dataset on government wages, corresponding econometric methods will be used to study the impact of government wages on corruption. Previous studies on this issue often employed cross-country regression models. The relatively long time dimension of the data allows using panel data econometric models. The model in Chapter 4 uses an aggregate measure of corruption, namely, an index of perceived corruption at the country level from the International Country Risk Guide Database, which is maintained by the Political Risk Analysis Group. This database covers a large number of countries since 1984.

While such country level perception-based corruption measures have been vital to further our understanding of the problem (Rose-Ackerman, 2004), they may not fully reflect corruption in each country (Olken, 2009; Treisman, 200;). Aggregate measures also ignore that corruption may vary substantially within a country (Sah, 2007). To improve on the measurement of corruption, the World Bank's Enterprise Unit conducts a large number of firm level surveys focusing on developing and transition economies. The program started in 2002 and is still in progress. A large database of about 130,000 firms from 135 countries has been made available for economic research. The Enterprise Survey database provides data on both perceptions of corruption and actual costs of corruption. Using these data, nonlinear econometric models, i.e. Ordered Probit and Tobit models, will be employed in Chapter 5 to study the impact of government wages on corruption at the firm level. In comparison with the models in Chapter 4, the application in Chapter 5 covers a shorter time period because the surveys have been repeated only a few times in each country.

1.4 Outline of the thesis

The thesis will proceed as follows. Chapter 2 presents the newly collected worldwide database on wages, while Chapter 3 compares different approaches of measuring government wages. Chapter 4 analyzes the impact of government wages on corruption at the country level using panel data econometric methods. Chapter 5 focuses on the relationship between wages and corruption at the industry level using nonlinear econometric methods. Finally, Chapter 6 concludes.

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Chapter 2
Industrial wages across countries and over time: A new database of micro survey data

2.1 Introduction[1]

This chapter presents a newly collected database of industrial wages for a large number of countries between the late 1980s and 2011. The main sources of this database are micro surveys, such as household budget surveys, labor force surveys or labor-related surveys. To the best of our knowledge, this is the first attempt to combine a diverse, scattered pool of survey data—which have been available for a large number of countries over the last two decades—into a unified database. As more data on micro surveys are being made available online through national data archives as well as cross-country databases, this database will be updated and expanded regularly in the future. The most recent version of the database can be downloaded online at http://www.levanhab28.com.

Industrial wages in this chapter are defined as the average nominal wages and salaries of all employees working in an industry. We determined the wages for each of the 17 one-digit level industries classified by the International Standard Industrial Classification of All Economic Activities, Revision 3 (ISIC 3). Different from the International Standard Classification of Occupations (ISCO), which classifies workers according to the skill content of their jobs, the ISIC describes the type of goods or services produced by the industry in which a person works. Although survey data are far from perfect and contain systematic (next to random) errors, validation studies have found that survey reported mean wages are the unbiased estimate of the true figures, i.e. the average wages in the population (Bound, 2001; Le et al., 2013a). Le et al. (2013a) showed that industrial wages as obtained from macro data (i.e. by dividing the wage bill by employment) yield biased results. As such, this dataset enables a better understanding of the variation of inter-industry wages, both between and within countries. It will also provide a more reliable source of data to support empirical research on the determinants of such variations as well as their implications for other aspects of the economy. Micro survey data play an increasingly

[1]This chapter is based on Le, V.H., De Haan, J., Dietzenbacher, E., 2013. Industrial wages across countries and over time: A new database of micro survey data. University of Groningen, The Netherlands.

important role in social science research as well as policy analyses. However, the potential of using survey data to study economic issues related to wages is still largely neglected.

Virtually all countries have conducted surveys on income and work in one form or another. Some countries, such as the US, Sweden and Argentina, maintain very long series of surveys with comprehensive data on income and work starting in the 1970s or even earlier. Other countries, such as Vietnam, Albania and Uganda, have only recently made household surveys a source of information for policy analysis thanks to the financial and technical support from international organizations. The results of such surveys are often made available via the World Bank or the International Labor Organization. Several countries offer free access to the original micro datasets for academic research via their own national data archives or international micro databases, such as the World Bank Living Standard Measurement Study or the Luxembourg Income Study. This availability enabled us to build a database on industrial wages across countries and over time. Our dataset was collected from 9 different international databases and a number of national data archives. The final database is a panel which consists of 1,488 observations from 126 countries. On average, there are almost 12 observations per country, but the number of observations varies substantially across countries.

The chapter will proceed as follows. Section 2.2 presents the methodology to compute industrial wages. Section 2.3 documents the data sources and the statistical operations applied to the data. Section 2.4 presents some detailed information about the database. Section 2.5 gives some suggestions on how the database could be used and Section 2.6 concludes.

2.2 Methodology

2.2.1 The ISIC 3

The ISIC system was introduced in 1958 by the United Nations. Since then, it has been revised several times to meet the changes in industrial structure as well as the introduction of new economic activities. The first revision took place in 1968 (ISIC 2), the second revision was in 1989 (ISIC 3), and the latest revision (ISIC 4) was in 2008. Most micro survey data available by 2013 still follow the ISIC 3 classification. Some countries have employed the ISIC 4 classification, but parallel information based on ISIC 3 is often provided. The data prior to the 1990s, which mostly follow the ISIC 2 classification, are difficult to obtain and are incompatible with the data classified according to ISIC 3. For this reason, we only focused on the late 1980s – 2011 period.

Table 2.1 presents the ISIC 3 industrial structure. Column (1) presents the first level industries, which is labeled alphabetically from A to Q. The ISIC 3 classification, therefore, consists of 17 one-digit industries. Column (2) gives the definition for each industry. Columns (3), (4) and (5) present the range of the ISIC 3 classification at the two, three and four digits levels, respectively. For example, industry D is classified into 23 two-digit industries, numbering from 15 to 37 as column (3) of Table 2.1 indicates. Examples of these two-digit industries are Manufacture of textiles (17); Manufacture of basic metals (27); and Manufacture of other transport equipment (35). The three-digit level further classifies each two-digit industry into a number of narrower industries. For example,

industry 35 includes 3 three-digit industries, namely Manufacture of basic iron and steel (271); Manufacture of basic precious and non-ferrous metals (272); and Casting of metals (273). Similarly, the four-digit level divides each three-digit industry into a number of smaller industries. Hence, the higher the number of digits, the more detailed information is available for the product or services produced by an industry.

Table 2.1. The structure of the ISIC 3 classification of industries

Industry	Definition	2 Digits	3 Digits	4 Digits
(1)	(2)	(3)	(4)	(5)
A	Agriculture, hunting and forestry	01-02	011-015	0111-0150
B	Fishing	05	050	0500
C	Mining and quarrying	10-14	101-142	1010-1429
D	Manufacturing	15-37	151-372	1511-3720
E	Electricity, gas and water supply	40-41	401-410	4010-4100
F	Construction	45	451-455	4510-4550
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	50-52	501-526	5010-5260
H	Hotels and restaurants	55	551-552	5510-5520
I	Transport, storage and communications	60-64	601-642	6010-6420
J	Financial intermediation	65-67	651-672	6511-6720
K	Real estate, renting and business activities	70-74	701-749	7010-7499
L	Public administration and defense; compulsory social security	75	751-753	7510-7530
M	Education	80	801-809	8010-8090
N	Health and social work	85	851-853	8511-8532
O	Other community, social and personal service activities	90-93	900-930	9000-9309
P	Private households with employed persons	95	950	9500
Q	Extra-territorial organizations and bodies	99	990	9900

Survey data from different countries vary. Some countries only report information at the one-digit level, while others collect data up to the four-digit level. We chose to present industrial wages at the one-digit level for two reasons. First, focusing on the first level will ensure that the resulting data are more reliable. There are 17 one-digit, 60 two-digit, 159 three-digit, and 298 four-digit ISIC 3 industries. For some countries, however, the sample contains only about 1,000 surveyed individuals for which complete information on industry of work and wages is available. Extending the number of industries would then imply that some industries only have a few sampled individuals. A sample that is too small will result in estimated average wages that are unreliable. Second, many data at our disposal only contain information up to the ISIC 3 one-digit level, so that focusing on higher ISIC levels will lead to a significant reduction in the number of countries in the database.

2.2.2 Wage concepts

The most comprehensive wage concept is wages and salaries defined in the 2008 System of National Accounts (SNA 2008, see United Nations, 2009. Wages and salaries include basic wages and salaries, overtime payment, and regular and irregular bonuses. Wages and salaries also include social contributions, income taxes, etc., payable to the employee (even

if they are actually withheld by the employer for administrative convenience or other reasons and paid directly to social insurance schemes, tax authorities, etc., on behalf of the employee). Wages and salaries may be paid in various ways, including goods or services provided to the employees as remuneration in kind instead of, or in addition to, remuneration in cash (SNA 2008).

In the ideal case, a dataset of industrial wages should employ the same concept of wages and salaries. However, the concept of wages and salaries used in surveys varies from one country to the other. Some countries report gross salary/pay, while others collect data on wages and salaries after taxes and social contributions. Even for the same country, the concept of wages used in different surveys over time can be different, because surveys are reviewed periodically and changes in the questions on income may occur in subsequent rounds.

Given this situation, we did not seek a common definition of wages in our database. Instead, we retain the concepts of wages used in each underlying survey. As a result, the industrial wages reported in our database vary across countries and sometimes over time as well. A variable named WAGE_CONCEPT is included in the database to outline the concept of wages and salaries used in a particular survey.

Comparing industrial wages across countries may not be appropriate when the wage concepts used in the underlying surveys differ from each other. Similarly, the trend analysis of industrial wages series may be disrupted if the wage concept within a country changes from one year to the other. However, the differences in wage concepts used will be less of a problem in studies that focus on relative differences in wages and salaries across sectors. This is because the wage concepts always apply consistently to all sectors within one survey. If components of wages do not differ across industries, the relative position of industries will not depend on the use of a particular wage concept.

2.2.3 Time basis

Time basis refers to the reference period of the wages and salaries (e.g. dollars per year or per hour). Similar to the wages and salaries concept used, also the time basis varies between and within countries. Within the pool of original micro datasets that we have collected, 8 different time bases have been used, namely yearly, 6 months, 3 months, monthly, fortnight, weekly, daily and hourly. The time basis may even vary within one survey. If that is the case, we convert the reported income into the most commonly used time basis in the respective survey and report the wages according to that basis. The variable TIME_CONCEPT in the database provides the time basis for the reported wages and salaries.

Most surveys provide information on weekly hours worked. As a result, we could also compute hourly wages by dividing the reported wages by the corresponding number of hours worked. For example, if an individual works 38 hours per week and receives a monthly payment P, his hourly wages are computed as the monthly payment divided by the number of hours worked per month, which yields $P \times 12/(38 \times 52)$. The hourly wages take differences in working hours across individuals into account. However, survey data on hourly wages are less accurate than data on weekly, monthly and yearly wages (Bound et al., 2001). Even so, we computed hourly wages in companion with non-hourly wages whenever the underlying survey data provided enough information to do so.

2.2.4 Estimation procedures

The estimation procedures consisted of two steps. First, surveyed individuals with a positive amount of income from the main job are classified into one of the 17 ISIC 3 industries as shown in Table 2.1. Second, average wages of each industry were estimated as the mean reported wages from the main job of all individuals within that industry. More specifically, the wages of industry *i* in a given country at time *t* were estimated as:

$$\boldsymbol{W_{it}} = \frac{\mathbf{1}}{\sum_{j=1}^{n_{it}} \boldsymbol{p_{itj}}} \sum_{j=1}^{n_{it}} (\boldsymbol{p_{itj}} \times \boldsymbol{w_{itj}})$$

where W_{it} are the wages of industry *i* at time *t*, w_{itj} are the reported wages of the surveyed individual *j* in industry *i* at time *t*, n_{it} is the number of surveyed individuals in industry *i* at time *t*, and p_{itj} is the sampling weight of individual *j* in industry *i* at time *t*. These sampling weights are provided in each dataset to account for the differences in sampling probability between individuals. When the sampling process is completely random, individuals within each country will have an equal probability of being surveyed. In that case the weight $p_{itj} = 1$ and the expression reduces to $W_{it} = \sum_{j=1}^{n_{it}} w_{itj} / n_{it}$. However, in practice, most surveys are stratified along several dimensions and the probability of being interviewed is different from one individual to another. The sampling weight p_{itj} is included to account for this difference.

In most survey datasets that we obtained, the wages are paid on a non-hourly basis. As indicated in the previous subsection, hourly wages (w_{itj}^h) were obtained by dividing the non-hourly wages (w_{itj}) by the corresponding number of hours worked. The hourly wages of each industry (W_{it}^h) were estimated in the same way as the non-hourly wages above. That is,

$$\boldsymbol{W_{it}^h} = \frac{\mathbf{1}}{\sum_{j=1}^{n_{it}} \boldsymbol{p_{itj}}} \sum_{j=1}^{n_{it}} (\boldsymbol{p_{itj}} \times \boldsymbol{w_{itj}^h})$$

We also estimated the hourly (W_t^h) and non-hourly wages (W_t) for the whole country in year *t* as the mean wages of all individuals in all industries. For example,

$$\boldsymbol{W_t} = \frac{\mathbf{1}}{\sum_{i=1}^{17} \sum_{j=1}^{n_{it}} \boldsymbol{p_{itj}}} \sum_{i=1}^{17} \sum_{j=1}^{n_{it}} (\boldsymbol{p_{itj}} \times \boldsymbol{w_{itj}})$$

and a similar expression holds for W_t^h.

2.3 Data sources

2.3.1 Original micro survey datasets

The main sources of the original household survey datasets that we collected include 6 international databases together with a number of national data archives. The international databases are the World Bank Living Standard Measurement Study (LSMS), the European Community Household Panel (ECHP), the European Union Statistics on Income and Living Conditions (EU-SILC), the Luxembourg Income Study (LIS), the Integrated Public Use Microdata Series (IPUMS), and the Economic Research Forum (ERF). National data archives are online databases that offer original micro survey datasets conducted in each country and over time, such as the Current Population Survey (CPS) from the United States. Access to these data is often free for academic research purposes (under certain conditions). In total, we were able to collect 898 datasets from 64 countries between the late 1980s and 2011.

For some countries, the information on the ISIC 3 classification of respondents is missing. When the industry of work is available, some surveys do not report data on wages or fail to distinguish income from work and income from other sources. We consulted the accompanying manuals and questionnaires carefully to ensure that the necessary information is correctly recorded and only retained surveys with data of good quality.

Except for the surveys for Vietnam, the United States and the EU-SILC, all other datasets report data on a monthly basis. However, data on bonuses and overtime payment as well as earnings in kind are—when available separately—often on a less regular basis, such as 3, 6 or 12 months. In that case, we converted these incomes to a monthly basis and added the resulting income to the monthly wages to obtain the monthly earnings data. The obtained earnings data can either be in gross terms or in net terms. The resulting earnings figures were considered as the final reported wages and salaries of the surveyed individuals and were used to estimate the industrial wages and salaries.

Most original micro datasets for Latin American countries are not processed because these data have been harmonized and analyzed by the Socio-Economic Database for Latin America and the Caribbean countries (SEDLAC). SEDLAC makes the resulting estimated industrial wages available. In total, we processed 363 datasets from 46 countries (excluding all SEDLAC countries), resulting in 363 observations.

2.3.2 Secondary data on industrial wages

Secondary data are international databases that provide country data on survey-based estimated wages for ISIC 3 industries. In constructing our dataset on industrial wages, we have used information from three existing databases. These are SEDLAC, the International Labor Organization's LABORSTA and its successor, ILOSTAT.

SEDLAC is a database that provides several socio-economic statistics for 25 Latin American and Caribbean countries. It is the result of the cooperation between the Center for Distributional, Labor and Social Studies (CEDLAS) of the University of La Plata and the World Bank's Latin America and the Caribbean Poverty and Gender Group (LCSPP). SEDLAC provides data on mean net monthly earnings and hourly wages based on

household budget survey data. Instead of reporting data by ISIC 3 industries, SEDLAC provide average wages for 10 sectors. These sectors are primary activities; low-tech industries; high-tech industries; construction; commerce; utilities and transportation; skilled services; public administration; education and health; and domestic servants.

Appendix 2.A shows details on the relationship between these 10 sectors and the ISIC 3 industries. The wages for construction (industry F in Table 2.1) can be obtained directly from the SEDLAC database. The wages for manufacturing (industry D) can be obtained as the weighted average of the wages of the low-tech and hi-tech sectors (the detailed formula is presented in Appendix 2.A). Each of the other 7 SEDLAC sectors combines some ISIC 3 one-digit industries together. We report the wages for these sectors as they are reported in the SEDLAC database. 273 observations on wages and salaries have been collected from this database.

LABORSTA provides data on average wages for ISIC 3 industries for a large number of countries. The ILO Department of Statistics sends questionnaires to the corresponding government agency in each country/territory to collect data on various labor statistics. With respect to industrial wages, the corresponding agency is requested to provide data on gross earnings by ISIC industries. When data on average earnings is not available, data on the average wage rates is provided instead. A detailed list of components of remuneration to be included in each wage concept is also included in the questionnaires. When the questionnaires are returned to the ILO, the data are checked for their consistency and made freely available online at http://laborsta.ilo.org/ (Hua, 2008). More recently, the LABORSTA database has been replaced by ILOSTAT, which provides data on earnings for 2009 and 2010.

We included LABORSTA and ILOSTAT into our database. For the period from the late 1980s to 2010, we were able to collect 1,156 observations from 115 countries and territories. However, the data are not evenly distributed between countries. For some countries there is a very long data series while for many other countries there is only one observation.

One drawback of the ILO data is that several countries only report data on the private sector, leading to missing data for public administration. Some other countries exclude small establishments with less than a certain number of employees (mostly 5 or 10). In our database the variable NOTES explains such deviations in some detail.

2.4 Results

The final database includes three separate datasets corresponding to the three data sources that have been used, namely the SEDLAC, the ILO databases and the original micro datasets that we have collected. Appendix 2.B provides summary information on the data source for each country in all years covered in the database. The database documents data sources as well as the processing steps applied to get each observation.

In addition, there is a unified dataset that combines these three datasets. Sometimes we have more than one observation for a particular country-year. In that case we retained the entry that provides more comprehensive data, both in terms of the number of industries covered and the wage concepts used. When two different sources provide the same wage concept and time basis, the longer series has been retained.

For France, for example, the ECHP provides data for the average gross monthly earnings in cash in the 1994-2001 period and the EU-SILC for gross yearly earnings in cash and in kind for the 2003-2010 period. At the same time, the ILO provides data on gross monthly earnings in cash for the 1999–2002 period. So there are multiple entries for France in 1999, 2000 and 2001. We chose to include data for France for the 1994-2001 period from the ECHP because this ensures continuity of the data series.

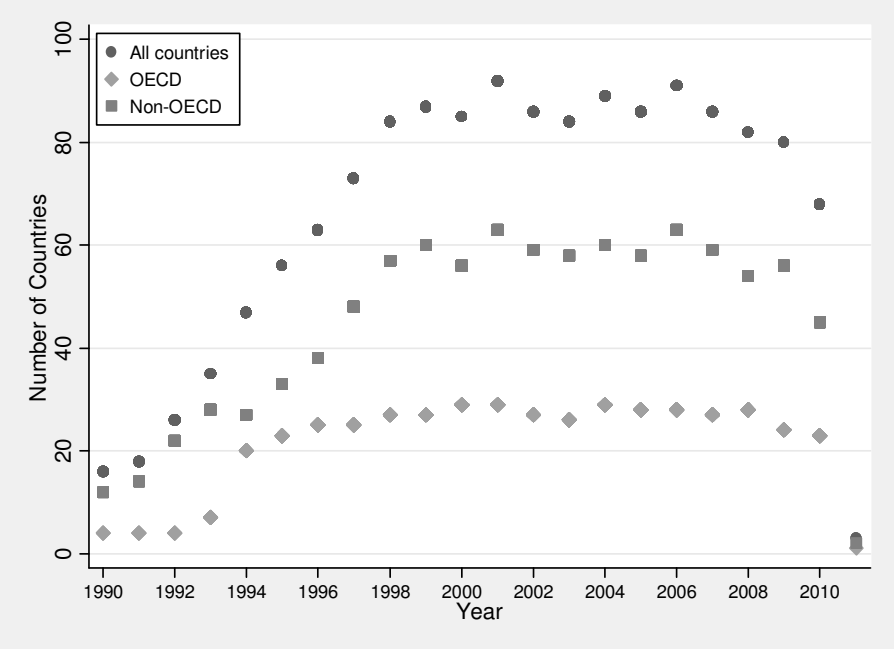

Figure 2.1. The number of countries included in the dataset by year and by OECD status

The final combined dataset consists of 1,488 observations from 126 countries and territories. Each observation consists of up to 36 entries (non-hourly and hourly wages for each of the 17 industries and for the whole economy). Figure 2.1 presents the number of observations per year, distinguishing between OECD and non-OECD countries.[2] There are less than 20 countries included in the database in the early 1990s. However, the number of countries increases gradually and reaches about 90 in the mid-2000 years. In 2010 and 2011, the number of countries appears to be smaller because of the lag in data dissemination.

[2]A country is classified as an OECD member from the year it is admitted to the OECD. The increase in the number of OECD countries may therefore reflect that data from more OECD countries have become available and/or that OECD membership has increased.

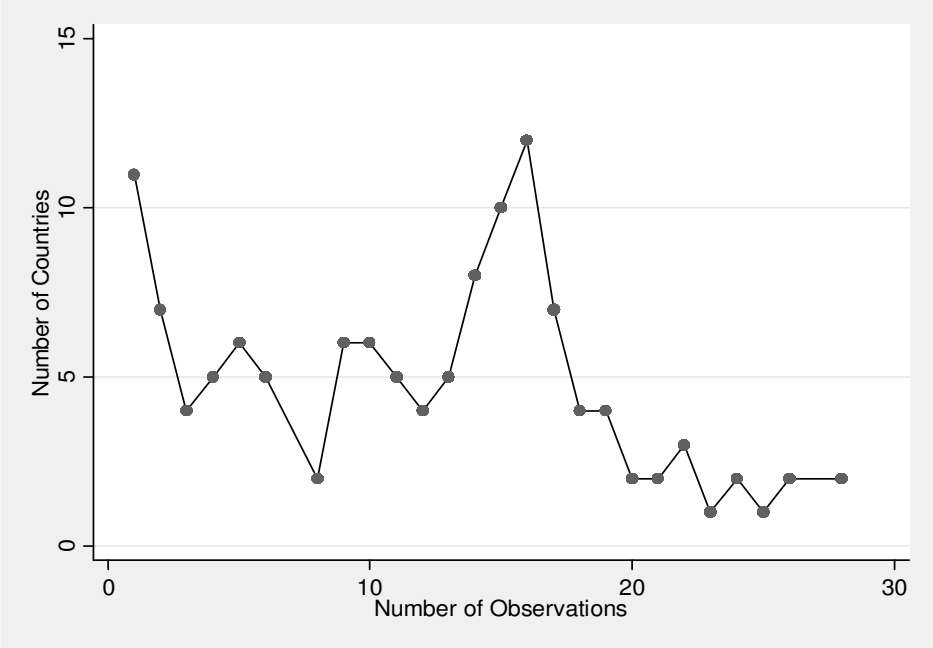

Figure 2.2. The number of countries by observations

Figure 2.2 graphs the number of observations per country on the horizontal axis and the number of countries on the vertical axis. The figure shows that 11 countries have only one observation, and 14 countries have 20 observations or more. On average, there are 11.81 observations per country.

Table 2.2 lists the types of surveys underlying our database. More than 45% of the data are from labor related establishment surveys[3], almost 40% are from household budget surveys, and about 10% of the data are from labor force surveys. Less than 6% of the data are from other sources, such as administrative reports, tax records and population censuses. The variable SOURCE in the database gives details about the type of survey for each observation in the database

[3] Labor related establishment surveys are conducted at the establishment level, while labor force surveys collect information by interviewing individuals. In some countries, the labor related establishment surveys exclude small firms having a number of employees below a certain threshold. The most commonly applied threshold is 5 but sometimes it is 10 or 20.

Table 2.2. Types of surveys

Source of data	Frequency	Percent
Establishment survey	674	45.39
Household budget survey	588	39.53
Labor force survey	144	9.56
Insurance records	41	2.76
Administrative reports	29	1.95
Tax records	9	0.61
Population census	3	0.2

For the estimation of industrial wages, all surveys should ideally have the same coverage of workers. However, this is not the case. Four different levels of worker coverage are used in the data sources mentioned in Table 2.2, namely: total coverage; employees; salaried employees; and wage earners. Total coverage includes employees and self-employed individuals such as business owners, own account workers and members of producers' cooperatives. Employees refer to both salaried employees and wage earners, i.e. total paid employment. Wage earners are low-skilled workers whose wages depend on their hours worked, while salaried employees receive a payment that is independent of the number of hours worked. Table 2.3 presents the composition of the database by level of worker coverage. The table shows that most observations refer to data on wages paid to employees. Only some observations have a different level of coverage. The variable WORKER in the database provides information about the worker coverage of the underlying survey.

Table 2.3. Worker coverage

Worker coverage	Frequency	Percentage
Employees	1,434	96.57
Total coverage	4	0.27
Salaried employees	21	1.41
Wage earners	26	1.75
Total	1,485	100

Table 2.4 presents the composition of our database with respect to the concept of wages that is used. About 72% of the cases report data on a monthly basis, out of which 52% refer to gross monthly earnings. There are 298 observations, equivalent to 20% of the cases, which report data on net monthly earnings. Earnings per year, earnings per week and earnings per hour are the next three major categories, which account for 10%, 8% and 4%, respectively. Less than 6% of the data are based on other concepts of wages, such as monthly salary, earnings per day or wage rate per day. The variable WAGE_CONCEPT in the database gives details about this issue.

Table 2.4. Wage Concepts

Wage Concepts	Number of Observations	Percentage
Earnings per month	771	51.92
Net monthly labor income	269	18.11
Earnings per year	153	10.3
Earnings per week	112	7.54
Earnings per hour	67	4.44
Net monthly earnings	29	1.95
Wage rates per day	24	1.62
Net monthly salary	18	1.21
Wage rates per month	118	1.08
Earnings per day	14	0.94
Net yearly earnings	13	0.88
Total	1,488	100

2.5 Suggestions for future usage of the database

Most studies on cross-country industrial wage differentials thus far use macro data, mainly coming from the national accounts (Gaetano, 2011; Genre et al., 2011; Gittleman and Wolff, 1993; Hartwig, 2011). For some countries, this type of data has been found to be potentially biased (Bloem et al., 1998). Moreover, macro-based industrial wages are imputed by dividing total wages by total employment in each industry. This imputation practice has been found to produce biased industrial wages (Le et al., 2013a).

In contrast, micro survey data provide an unbiased estimate of wages (Bound et al., 2001; Le et al., 2013a). Therefore, our database will offer an alternative and more reliable basis to revisit empirical findings which are based on macro data. More importantly, this database will open new opportunities for research on different relevant economic issues in a large number of countries.

First, this database enables research—with reliable data—to further our understanding of the structure of industrial wages, both within and between countries. Although the concept of wages varies between countries and sometimes within one country, the wage concept is consistently used within one survey. As such, our database will be suitable for analyzing relative wages of different industries within a country. To the extent that taxes and components of wages other than the basic wages and salaries rate are proportional to total earnings, research concerning the inter-industry wage structure will not be likely to suffer from any loss of precision.

Figure 2.3 graphs the ratio of the average wages of some industries to the average wages of the whole economy. Each industry is indicated by its ISIC 3 one-digit level. The figure reveals that the inter-industry wage structure is relatively stable over time. Previous studies on inter-industry wages focused on industrial countries due to lack of data for developing countries. Our database enables the study of the inter-industry wage structure on a worldwide basis and to examine differences between different sets of countries.

Second, our database can be used to study the determinants of the inter-industry wage structure for a large number of countries. Based on a sample of 8 Euro area countries over the 1991-2002 period, Genre et al. (2011) find that human capital, firm characteristics as well as socio-cultural and institutional factors play a major role in explaining inter-industry

wage differentials. Our database will help extending this line of research to other countries, especially developing countries for which data availability is often a severe problem. This database will also provide a basis for empirical studies on the impact of globalization, especially the possible impact of international trade and capital flows, on the relative wage position of tradable industries, such as manufacturing and mining, and non-tradable sectors, such as education, public administration and health.

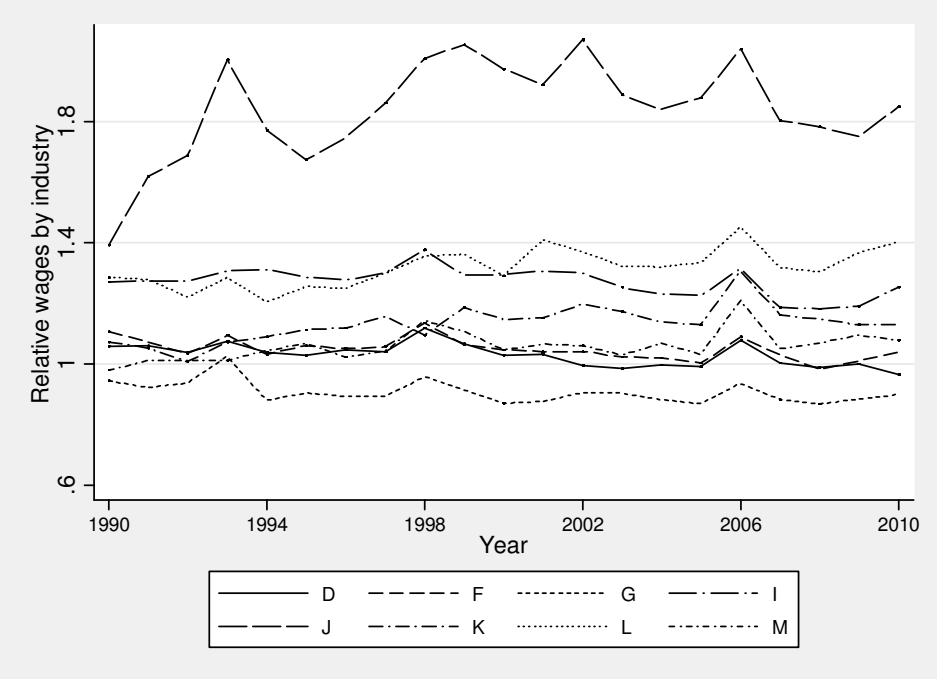

Figure 2.3. The inter-industry wage structure

Third, our database offers a new opportunity to study the impact of the inter-industry wage structure on different aspects of the economy. There is a large body of literature on the relationship between wages and workers' performance. According to the efficiency wage theory, high-paid workers will be less likely to shirk and more willing to exert effort to fulfill their duty. This will improve the profitability of their firms and—at the aggregate level—the efficiency of the whole industry. This line of argument has been applied to investigate the relationship between government wages and corruption (Van Rijckeghem and Weder, 2001) and the quality of government (La Porta et al., 1999). Similarly, our database can be employed to extend the analysis to the relationship between wages and service quality in other industries, such as education, and health and social work.

Table 2.5. The share of government employment by ISIC 3 industry and by government levels

Industry/Sector	ALL	OECD	Non-OECD	Africa	America	Asia	Europe
A	0.11	0.10	0.13	0.11	0.01	0.13	0.12
B	0.10	0.08	0.12	0.01	0.03	0.13	0.15
C	0.35	0.35	0.36	0.30	0.05	0.41	0.39
D	0.07	0.03	0.18	0.19	0.02	0.21	0.06
E	0.43	0.24	0.61	0.80	0.35	0.66	0.38
F	0.07	0.05	0.11	0.14	0.05	0.10	0.07
G	0.03	0.01	0.07	0.06	0.00	0.09	0.03
H	0.05	0.04	0.11	0.02	0.01	0.16	0.06
I	0.31	0.32	0.27	0.30	0.11	0.34	0.38
J	0.19	0.11	0.41	0.52	0.05	0.62	0.17
K	0.13	0.09	0.26	0.14	0.04	0.40	0.13
L	0.95	0.95	0.96	0.96	0.98	0.95	0.94
M	0.80	0.81	0.78	0.89	0.70	0.77	0.83
N	0.59	0.55	0.70	0.73	0.30	0.76	0.67
O	0.25	0.25	0.25	0.28	0.05	0.33	0.27
P	0.07	0.10	0.05	0.05	0.09	0.03	0.07
Q	0.46	0.78	0.24	0.50	0.07	0.26	0.75
Public sector	0.27	0.27	0.29	0.38	0.15	0.28	0.31
General government	0.19	0.20	0.17	0.28	0.13	0.16	0.22
Public administration	0.08	0.08	0.07	0.11	0.05	0.07	0.09
Wage ratio	1.01	1.01	1.00	1.01	1.00	1.01	1.01
No. countries	43	19	24	3	14	6	20
No. surveys	194	140	54	4	44	18	128

This table presents the share of government employment by industries, government levels and by groups of countries. The rows labeled from A to Q represent the share of government employment relative to total employment in each industry. The rows Public sector, General government, and Public administration show the share of employment by these government levels relative to total employment. The Wage ratio row presents the mean of the ratio of government public administration wages to the wages of the whole public administration; defense; and compulsory social security industry.

Finally, our database can be used to infer government wages. The database gives the average wages of the public administration (industry L in Table 2.1). This narrow definition of the government excludes government activities in areas such as education and health, while it includes some private sector activities. However, based on a sample of 194 surveys from 43 countries (for which we have data to classify government and non-government employment in the public administration industry) it can be shown that the wages of the public administration industry are a good proxy for government wages. Table 2.5 presents a summary of the results (detailed results are available on request).

In Table 2.5, column All presents the information for all countries included in this analysis. Columns OECD, non-OECD, African, American, Asia and Europe present the information for respective subsets of countries. Rows A to Q show, for each of the 17 ISIC 3 industries, the share of government employment in the industry's total employment. The rows Public sector shows its share in total employment of a country. Similar definitions hold for the rows General government and Public Administration. The row Wage ratio shows the mean of the ratio of the wages of the government part of public administration to the wages of the whole industry L (Public administration; defense; and compulsory social security).

It can be seen from this table that the government part of public administration accounts for only less than one half of the employment in the general government sector and less than one third of the total public sector employment (which includes the employment of the general government sector and the state owned enterprises). As expected, the share of government employment in industry L is 94% or higher. The row "Wage ratio" shows that the mean of the wage ratio is 1.01 and remains almost the same for different groups of countries. Its standard deviation is 0.016 (not reported in the table). These findings are quite similar across continents as well as between developed and developing countries. They clearly indicate that the wages of the public administration industry (L) serve as a good proxy for the wages in the government part of public administration. Using these data on government wages, Le et al. (2013b) find strong evidence that higher government wages reduce corruption in low-income countries.

2.6 Conclusion

Lack of data has been a stumbling block in empirical research on industrial wages at the cross-country level. Most studies so far relied on data from national accounts and were mostly confined to a group of developed countries with relatively good data at the macro level. This chapter introduces a micro-based database which covers a large number of developing—next to developed—countries. It thus makes it possible to extend analyses to countries which have so far been neglected due to lack of data. As more survey data become available, the database will be updated regularly in the future.

The database consists of 4 datasets. The first three datasets correspond to the data collected from the ILO, the SEDLAC, and the original micro survey datasets we have collected from 6 international databases and several national archives. The fourth dataset combines these three datasets into a unified dataset. When a particular country-year has more than one observation, this unified dataset includes the observation which is based on the more comprehensive concept of wages. When two observations are based on the same wage concept, the observation from the series which is available for the longest time span is included.

Although the concept of wages, time basis and worker coverage vary from one country to another, our database is suitable for studying relative wages between industries within the same country and between countries. This is because the concepts of wages, time basis and worker coverage used in the database are consistent within each country-year. Therefore, analyses based on relative wages are not likely to suffer from any loss of precision. Authors who are interested in comparing the level of industrial wages between countries or analyzing the trend of wages over time should consult the explanatory notes as well as the concept variables which are provided in the database to ensure that data are comparable across countries and over time.

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2.8 Appendices

2.8.1 Appendix 2.A. The correspondence between SEDLAC sectors and ISIC industries

ISIC	Primary activities	Industry low tech	Industry high tech	Constructio	Commerce	Utilities & transportati	Skilled services	Public administrat	Education & Health	Domestic servants
ISIC 3	A - Agriculture, forestry and	D - Manufacturing		F - Constructio n	G - Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	E - Electricity, gas and water supply	J - Financial intermediati on	L - Public administrati on and defence; compulsory social security	M - Education	P - Private households with employed persons
	B - Fishing				H - Hotels and restaurants	I - Transport, storage and communicat ions	K - Real estate, renting and business activities	Q - Extra-territorial organization s and bodies	N - Health and social work	
	C- Mining and quarrying						O - Other community, social and personal service activities			

Manufacturing (industry D) wages from SEDLAC are the average of the wages of the low tech and high tech sectors, weighted by the labor share of the two sectors in the sample. Suppose that a sample of N manufacturing workers is surveyed, of which N_l are in the low tech sector and N_h in the high tech sector. The corresponding average wages are W_l and W_h. The average wages for the manufacturing industry are then obtained as

$$\boldsymbol{W_m = \frac{N_l}{N_l + N_h} W_l + \frac{N_h}{N_l + N_h} W_h}$$

Information on the shares $N_l/(N_l + N_h)$ and $N_h/(N_l + N_h)$ is given in the SEDLAC database.

2.8.2 Appendix 2.B. List of countries and data sources included in the database

Country	Obs	Source 1*	Source 2	Source 3**
Albania	11	ILO: 1997-2006;	LSMS: 2002-2005, 2008	
Andorra	13	ILO: 1998-2010		
Anguilla	1	ILO: 1998-2010		
Argentina	24	SEDLAC: 1986-1989; 1992-2011		
Armenia	21	ILO: 1990-2010		
Aruba	1	ILO: 1998-2010		
Australia	3	LIS: 1995, 2001, 2003		
Austria	16	ILO: 1995-2003, 2009-2010;	ECHP: 1995-2001;	EU-SILC: 2003-2010
Azerbaijan	14	ILO: 1997-2010		
Bahamas	1	SEDLAC: 2001		
Belarus	2	ILO: 2009-2010		
Belgium	16	ILO: 1999-2007;	ECHP: 1994-1999, 2001;	EU-SILC: 2003-2009
Belize	5	SEDLAC: 1993-1994, 1997-1999		
Bermuda	6	ILO: 2004-2007, 2009-2010		
Bolivia	15	ILO: 1996-2000, 2009;	SEDLAC: 1993, 1997, 1999-2008	
Bosnia & Herzegovina	5	ILO: 2006; LSMS:2001-2004		
Botswana	12	ILO: 1997-2008		

Country	Obs	Source 1*	Source 2	Source 3**
Brazil	28	ILO: 1994-2002;	SEDLAC: 1981-1993, 1995-1999, 2002-2006, 2008 - 2009	
Bulgaria	15	ILO: 1996-2010;	EU-SILC: 2005-2010	
Canada	28	ILO: 1983-2010		
Chile	11	ILO: 2006-2008, 2010;	SEDLAC: 1990, 1992, 1996, 1998, 2000, 2003, 2006, 2009	
China	23	ILO: 1986-2008		
Colombia	14	ILO: 2002-2007;	SEDLAC: 1992, 1996, 1999-2010	
Costa Rica	22	ILO: 1998-2008, 2010;	SEDLAC: 1989-2010	
Croatia	15	ILO: 1996-2010		
Cuba	2	ILO: 2009-2010		
Cyprus	15	ILO: 1996-2006, 2009-2010;	EU-SILC: 2004-2008	
Czech Republic	26	ILO: 1985-2007, 2008-2009;	EU-SILC: 2004-2009	
Denmark	16	ILO: 1995-2007;	ECHP: 1994-1999, 2001; EU-SILC: 2003 - 2009	
Dominican Republic	15	ILO: 1996-2010;	SEDLAC: 1996-1997, 2000-2010	
East Timor	2	LSMS: 2001, 2007		
Ecuador	13	ILO: 1995-2004;	SEDLAC: 1994-1995, 1996-2000, 2003-2010	
Egypt	12	ILO: 1996-2007;	ERF: 1998, 2005	
El Salvador	16	ILO: 1998-2006;	SEDLAC: 1991, 1995, 1996, 1998-2006	
Estonia	19	ILO: 1992-2008;	EU-SILC:2003-2009	

Country	Obs	Source 1*	Source 2	Source 3**
Ethiopia	2	ILO: 2009-2010		
Finland	16	ILO: 1995-2010;	ECHP: 1996-2001;	EU-SILC: 2003-2009
France	16	ILO: 1999-2002;	ECHP: 1994-2001;	EU-SILC: 2003-2009
French Guiana	4	ILO: 1998-2001		
Gambia	3	ILO: 1993, 1994, 1998		
Georgia	14	ILO: 1997-2010		
Germany	15	ILO: 2007-2010;	ECHP: 1994-2001;	EU-SILC: 2003-2009
Gibraltar	10	ILO: 1998-2007		
Greece	16	ILO: 2000, 2002, 2006;	ECHP: 1994-2001;	EU-SILC: 2003-2010
Guadeloupe	4	ILO: 1998-2001		
Guatemala	5	SEDLAC: 2000, 2002-2004, 2006		
Guyana	5	SEDLAC: 1993;	ILO: 2003, 2004, 2006, 2007	
Haiti	1	SEDLAC: 2001		
Honduras	19	ILO: 2006;	SEDLAC:1991-2010	
Hong Kong	2	ILO: 2009-2010		
Hungary	19	ILO: 1992-2008;	EU-SILC: 2003-2010	
Iceland	12	ILO: 1996-2008;	EU-SILC: 2003-2009	
India	3	IPUMS: 1993, 1999, 2004		

Country	Obs	Source 1*	Source 2	Source 3**
Indonesia	4	ILO: 2007-2010		
Ireland	16	ILO: 1996-2006;	ECHP: 1994-2001;	EU-SILC: 2003-2009
Isle of Man	14	ILO: 1995-2008		
Israel	15	ILO: 1994-2010		
Italy	15	ECHP: 1994-2001;	EU-SILC: 2003-2010	
Jamaica	11	ILO: 2001-2008;	SEDLAC: 1990, 1996, 1999-2002	
Japan	10	ILO: 1999 - 2008		
Jersey	13	ILO: 1997-2009		
Jordan	16	ILO: 1994-2008;	ERF: 2010	
Kazakhstan	18	ILO: 1993-2010		
Kyrgyzstan	18	ILO: 1990-2007		
Latvia	21	ILO: 1990-2010;	EU-SILC: 2006-2009	
Lithuania	17	ILO: 1993-2009;	EU-SILC: 2004-2009	
Luxembourg	17	ILO: 1995-2010;	ECHP: 1994-1996, 1998-2001;	EU-SILC: 2003-2009
Macau	13	ILO: 1998-2010		
Macedonia	9	ILO: 2001-2008		
Madagascar	1	ILO: 2005		
Maldives	1	ILO: 2010		

Country	Obs	Source 1*	Source 2	Source 3**
Malta	10	ILO: 2000-2008;	EU-SILC: 2008-2009	
Martinique	4	ILO: 1998-2001		
Mauritius	12	ILO: 1999-2008		
Mexico	20	ILO: 1992-2008;	SEDLAC: 1989, even years between 1992-2010	
Moldova	15	ILO: 1996-2010		
Mongolia	11	ILO: 2000-2010		
Montenegro	4	ILO: 2007-2010		
Nepal	1	ILO: 1999		
Netherlands	16	ILO: 1994-2005;	ECHP: 1994-2001;	EU-SILC: 2004-2009
Netherlands Antilles	9	ILO: 1991-1998, 2000		
New Caledonia	1	ILO: 1999		
New Zealand	22	ILO: 1989-2010		
Nicaragua	6	ILO: 2009-2010;	SEDLAC: 1993, 1998, 2001, 2005	
Nigeria	1	LSMS: 2010		
Norway	14	ILO: 1997-2010;	EU-SILC: 2003-2009	
Panama	17	ILO: 1998-1999, 2002-2010;	SEDLAC: 1989, 1991, 1995, 1997-2007, 2009-2010	
Paraguay	14	ILO: 2007 – 2010;	SEDLAC: 1990, 1995, 1997, 1999, 2001 – 2010	
Peru	14	ILO: 2002-2010;	SEDLAC: 1997-2010	

Country	Obs	Source 1*	Source 2	Source 3**
Philippines	15	ILO: 1996-2010		
Poland	18	ILO: 1993-2008, 2010;	EU-SILC: 2004-2009	
Portugal	17	ILO: 1998-2010;	ECHP: 1994-2001;	EU-SILC: 2004-2009
Qatar	5	ILO: 2001, 2005-2007, 2009		
Romania	19	ILO: 1992-2007, 2009-2010;	EU-SILC: 2004-2009	
Russian Federation	10	ILO: 1995-1998, 2005-2010		
Saint Helena	9	ILO: 1994-2002		
San Marino	6	ILO: 2001-2006		
Saudi Arabia	2	ILO: 1997, 2009		
Serbia	9	ILO: 2003-2010;	LSMS: 2002, 2003, 2007	
Serbia & Montenegro	9	ILO: 1997-2005		
Seychelles	24	ILO: 1986-2009		
Slovakia	20	ILO: 1991-2010;	EU-SILC: 2004-2009	
Slovenia	26	ILO: 1985-2010;	EU-SILC: 2004-2010	
South Africa	10	NDA: 1997-1999, 2002-2008		
South Korea	16	ILO: 1993-2008;	LIS: 2006	
Spain	17	ILO: 1996-2009;	ECHP: 1994-2001;	EU-SILC: 2004-2010
Sri Lanka	2	ILO: 2009-2010		

Country	Obs	Source 1*	Source 2	Source 3**
Suriname	1	SEDLAC: 1999		
Sweden	17	ILO: 1993-2007;	ECHP: 1997-2001;	EU-SILC: 2003-2009
Switzerland	9	ILO: 1994-2008, every even year		
Taiwan	8	ILO: 2004-2008;	LIS 1995, 1997, 2000, 2005	
Tajikistan	10	ILO: 2000-2007;	LSMS: 1999, 2003, 2007, 2009	
Tanzania	3	NDA: 2001, 2008, 2010		
Thailand	8	ILO: 2001-2008		
Turkey	13	ILO: 1993-2005		
Uganda	5	NDA: 1999, 2002, 2006;	LSMS: 2009, 2010	
Ukraine	16	ILO: 1995-2010		
United Kingdom	25	ILO: 1986-2010;	ECHP:1994-2001;	EU-SILC: 2004-2010
United States	22	NDA: 1990-2011		
Uruguay	17	SEDLAC: 1989, 1992, 1995-2010		
Uzbekistan	6	ILO: 1994-1999		
Venezuela	18	SEDLAC: 1989, 1992, 1995, 1997-2011		
Vietnam	6	NDA: 1993, 1998, 2002, 2004, 2006, 2008		
Vincent & the Grenadines	11	ILO: 1992-2002		
West Bank & Gaza Strip	14	ILO: 1996-2009		

Country	Obs	Source 1*	Source 2	Source 3**
Zimbabwe	1	ILO: 2009		

ILO: International Labor Organization

SEDLAC: Socio-Economic Database for Latin American and the Caribbean Countries

ERF: Economic Research Forum

LIS: Luxembourg Income Study

LSMS: World Bank's Living Standard Measurement Study

IPUMS: Integrated Public Use Microdata Series

NDA stands for National data archive. The specific name of the source (which can be searched and accessed online) is provided in the Explanatory notes accompanying the data.

*Data on the public administration industry from SEDLAC include wages of extra territorial organizations and bodies (industry Q). However, the share of industry Q (also provided by SEDLAC) is negligible is negligible in these countries (i.e. equals zero or is less than 1% for most of the cases).

**Data on the manufacturing wages (industry D) from EU-SILC include wages of mining and quarrying (industry C), and water and electricity (industry E).

2.8.3 Appendix 2.C. The online explanatory notes accompanying the database

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Albania	11	ILO	1997-2006	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 2002-2005, 2008: data from LSMS. For other years, data are from ILO. The ILO data is less comprehensive in the sense that it only provide data for some industries
		LSMS	2002-2005, 2008	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		
Andorra	13	ILO	1998-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		data are from ILO only
Anguilla	1	ILO	1998-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		data are from ILO only
Argentina	24	SEDLAC	1986-1989; 1992-2011	Net earnings	Monthly Hourly	Employees	Cleaned, check for outliers	Monthly data is monthly labor income. Hourly data is wages from main the main job	data are from SEDLAC only
Armenia	21	ILO	1990-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Prior to 1994: roubles; 1 dram = 200 roubles	data are from ILO only

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Aruba	1	ILO	1998-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		data are from ILO only
Australia	3	LIS	1995, 2001, 2003	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights	Data are harmonized by the LIS - There are some data in the ILO referring to non-managerial employees. This data is not included because of compatibility problems	data are from LIS only
Austria	16	ILO	1995-2003, 2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	ILO data: Prior to 1999: ATS; 1 Euro = 13.7603 ATS.	- 1995-2001: Data from ECHP - 2002: ILO - 2003-2010: SILC
		ECHP	1995-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights	Earnings in kind not included	
		EU-SILC	2003-2010	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights	Data in 2010 are monthly gross earnings in cash	

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Azerbaijan	14	ILO	1997-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	From 2005: New denomination of AZM; 1 AZN = 5,000 AZM.	data are from ILO only
Bosnia and Herzegovina	5	ILO	2006				Cleaned, check for outliers		- 2002-2004: LSMS - 2006: ILO
		LSMS	2001-2004	Net salary	Monthly	Employees	- Employees with positive income are retained - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		
Bahamas	1	SEDLAC	2001	Net earnings	Monthly	Employees	Cleaned, check for outliers	Only whole country wages are available	data are from SEDLAC only
Belarus	2	ILO	2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		data are from ILO only
Belgium	16	ILO	1999-2007	Gross earnings	Monthly Hourly	Employees	Cleaned, check for outliers	1999,2000,2002: ILO 1994-1999, 2001: ECHP 2003-2009: EU-SILC	
		ECHP	1994-1999, 2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		Income in kind not included
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Belize	5	SEDLAC	1993-1994, 1997-1999	Net earnings	Monthly Hourly	Employees	Cleaned, check for outliers	Monthly data is monthly labor income. Hourly data is wages from main the main job	Data are from SEDLAC only
Bermuda	6	ILO	2004-2007, 2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		data are from ILO only
Bolivia	15	ILO	1996-2000, 2009	Wage rates	Monthly	Employees	Cleaned, check for outliers	2009 data are gross earnings	- 1996, 1998, 2009: ILO - 1993, 1997, 1999-2008: SEDLAC
		SEDLAC	1993, 1997, 1999-2008	Net earnings	Monthly	Employees	Cleaned, check for outliers		
Botswana	12	ILO	1997-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Private sector only	data are from ILO only
Brazil	28	ILO	1994-2002	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 1994, 2000, 2001: ILO - other years: SEDLAC
		SEDLAC	1981-1993, 1995-1999, 2002-2006, 2008 – 2009	Net earnings	Monthly Hourly	Employees	Cleaned, check for outliers	Monthly data is monthly labor income. Hourly data is wages from main the main job	

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Bulgaria	15	ILO	1996-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	From 1999: New denomination: 1 new lev = 1,000 old leva.	- Before 2005: ILO - From 2005: EU-SILC
		EU-SILC	2005-2010	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights	Data in 2010 are monthly gross earnings in cash	
Canada	28	ILO	1983-2010	Gross earnings	Weekly	Employees	Cleaned, check for outliers	There are some changes in the methodology, check the flag variables in the database for further information.	data are from ILO only
Chile	11	ILO	2006-2008, 2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 2007, 2008, 2010: ILO - Other years: SEDLAC
		SEDLAC	1990, 1992, 1996, 1998, 2000, 2003, 2006, 2009	Net earnings	Monthly Hourly	Employees	Cleaned, check for outliers	Monthly data is monthly labor income. Hourly data is wages from main the main job	
China	23	ILO	1986-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data are from the ILO only

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Colombia	14	ILO	2002-2007	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data are from the SEDLAC only
		SEDLAC	1992, 1996, 1999-2010	Net earnings	Monthly	Employees	Cleaned, check for outliers	Monthly data is monthly labor income. Hourly data is wages from main the main job	
Costa Rica	22	ILO	1998-2008, 2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data are from the SEDLAC only
		SEDLAC	1989-2010	Net earnings	Monthly	Employees	Cleaned, check for outliers	Monthly data is monthly labor income. Hourly data is wages from main the main job	
Croatia	15	ILO	1996-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		data are from ILO only
Cuba	2	ILO	2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		data are from ILO only
Cyprus	15	ILO	1996-2006, 2009-2010	Gross earnings	Monthly Hourly	Employees	Cleaned, check for outliers		- 2004-2008: EU-SILC - Other years: ILO
		EU-SILC	2004-2008	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Czech Republic	26	ILO	1985-2007, 2008-2009	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 2004-2009: EU-SILC - Other years: ILO
		EU-SILC	2004-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Denmark	16	ILO	1995-2007	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Private sector only	- 1999 - 2001: ILO - Other years: ECHP, EU-SILC
		ECHP	1994-1999, 2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
		EU-SILC	2003 – 2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Dominican Republic	15	ILO	1996-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 1998 - 1999: ILO - Other years: SEDLAC
		SEDLAC	1996-1997, 2000-2010	Net earnings	Monthly	Employees	Cleaned, check for outliers		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
East Timor	2	LSMS	2001, 2007	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		Data from LSMS only
Ecuador	13	ILO	1995-2004	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 1996-1997, 2001-2002: ILO - Other years: SEDLAC
		SEDLAC	1994-1995, 1996-2000, 2003-2010	Net earnings	Monthly	Employees	Cleaned, check for outliers		
Egypt	12	ILO	1996-2007	Gross earnings	Weekly	Wage earners	Cleaned, check for outliers	Wage earners are low skill workers	- 1998, 2006: Data from ERF - Other years: ILO
		ERF	1998, 2005	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights	Care should be taken in combining with ILO data	

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
El Salvador	16	ILO	1998-2006	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Prior to 2002: colones; 8.75 colones = 1 US dollar	data are from SEDLAC only
		SEDLAC	1991,1995, 1996, 1998-2006	Net earnings	Monthly	Employees	Cleaned, check for outliers		
Estonia	19	ILO	1992-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Data from the ILO is more continuous	- 2003-2009: EU-SILC - Other years: ILO
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Ethiopia	2	ILO	2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		data are from ILO only
Finland	16	ILO	1995-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 1995, 2002, 2010: ILO - 1996-2001: ECHP

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		ECHP	1996-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		- 2003-2009: EU-SILC
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
France	16	ILO	1999-2002	Gross earnings	Monthly	Employees	Cleaned, check for outliers		-1994-2001: ECHP - 2002, 2010: ILO - 2003-2009: EU-SILC
		ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
French Guiana	4	ILO	1998-2001	Gross Earnings	Hourly	Employees	Cleaned, check for outliers		Data from ILO only
Gambia	3	ILO	1993, 1994, 1998	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Georgia	14	ILO	1997-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Germany	15	ILO	2007-2010	Gross earnings	Hourly Monthly	Employees	Cleaned, check for outliers	- Data for 2007, 2008 are in hourly basis - There are also data on hourly for wage earners, but not included because they are not compatible with other data sources	- 2010: Data from ILO - Other years: Data from ECHP and EU-SILC
		ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Gibraltar	10	ILO	1998-2007	Gross earnings	Hourly	Wage earners	Cleaned, check for outliers		Data from ILO only
Greece	16	ILO	2000, 2002, 2006	Gross earnings	Monthly	Wage earners	Cleaned, check for outliers	- 2006 data cover employees	- 2002: ILO - Other years: ECHP and EU-SILC
		ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		EU-SILC	2003-2010	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights	- 2010 data: Gross earnings in cash	
Guadeloupe	4	ILO	1998-2001	Gross earnings	Hourly	Employees	Cleaned, check for outliers		Data from ILO only
Guatemala	5	SEDLAC	2000, 2006 2002-2004	Net earnings	Monthly	Employees	Cleaned, check for outliers		Data from SEDLAC only
Guyana	5	SEDLAC	1993	Net earnings	Monthly	Employees	Cleaned, check for outliers		- 1993: SEDLAC - Other years: ILO
		ILO	2003, 2004, 2006, 2007	Gross earnings	Monthly	Employees	Cleaned, check for outliers		
Haiti	1	SEDLAC	2001	Net earnings	Monthly	Employees	Cleaned, check for outliers		Data from SEDLAC only
Honduras	19	ILO	2006	Wage rates	Daily	Employees	Cleaned, check for outliers		Data from SEDLAC only
		SEDLAC	1991-2010	Net earnings	Monthly	Employees	Cleaned, check for outliers		
Hong Kong	2	ILO	2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Hungary	19	ILO	1992-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers	- Prior to 1999: enterprises with more than 20 employees.	

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		EU-SILC	2003-2010	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		- Before 2003: Data from ILO - From 2003: EU-SILC
Iceland	12	ILO	1996-2008	Gross earnings	Hourly	Wage earners	Cleaned, check for outliers		- Before 2003: Data from ILO - From 2003: EU-SILC
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
India	3	IPUMS	1993, 1999, 2004	Gross earnings	Weekly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		Data from IPUMS only
Indonesia	4	ILO	2007-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Ireland	16	ILO	1996-2006	Gross earnings	Weekly	Employees	Cleaned, check for outliers	- There is some data on wage earner, which are not included because of compatibility problems	- 2002: Data from ILO - Other years: ECHP, EU-SILC
		ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Isle of Man	14	ILO	1995-2008	Gross earnings	Weekly	Employees	Cleaned, check for outliers		Data from ILO only
Israel	15	ILO	1994-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Italy	15	ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		Combining data from ECHP and EU-SILC
		EU-SILC	2003-2010	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Jamaica	11	ILO	2001-2008	Gross earnings	Weekly	Employees	Cleaned, check for outliers		- 1990, 1996, 2000: SEDLAC - 2001-2008: ILO
		SEDLAC	1990, 1996, 1999-2002	Net earnings	Monthly	Employees	Cleaned, check for outliers		
Japan	10	ILO	1999 – 2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Jersey	13	ILO	1997-2009	Gross earnings	Weekly	Employees	Cleaned, check for outliers		Data from ILO only
Jordan	16	ILO	1994-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers		
		ERF	2010	Net earnings	Monthly	Employees	- Employees with positive income are retained - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		- 2010: Data from ERF - Other years: ILO
Kazakhstan	18	ILO	1993-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Kyrgyzstan	18	ILO	1990-2007	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Latvia	21	ILO	1990-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	EU-SILC data is more comprehensive in terms of wage concept but the ILO data offers a longer series	- Data from ILO only
		EU-SILC	2006-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Lithuania	17	ILO	1993-2009	Gross earnings	Monthly	Employees	Cleaned, check for outliers	EU-SILC data is more	Data from ILO only

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		EU-SILC	2004-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights	comprehensive in terms of wage concept but the ILO data offers a longer series	
Luxembourg	17	ILO	1995-2010	Gross earnings	Monthly	Salaried Employees	Cleaned, check for outliers		- 1997, 2002, 2010: ILO - Other years: ECHP, EU-SILC
		ECHP	1994-1996, 1998-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
		EU-SILC	2003-2009	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Macau	13	ILO	1998-2010	Gross earnings	Monthly	Total coverage	Cleaned, check for outliers		Data from ILO only
Madagascar	1	ILO	2005	Gross earnings	Hourly	Employees	Cleaned, check for outliers		Data from ILO only
Macedonia	9	ILO	2001-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Maldives	1	ILO	2010	Gross earnings	Hourly	Employees	Cleaned, check for outliers		Data from ILO only
Malta	10	ILO	2000-2008	Gross earnings	Hourly	Employees	Cleaned, check for outliers		-2000-2007: ILO - 2008-2009: EU-SILC
		EU-SILC	2008-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
							wages using relevant weights		
Martinique	4	ILO	1998-2001	Gross earnings	Hourly	Employees	Cleaned, check for outliers		Data from ILO only
Mauritius	12	ILO	1999-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Establishment with 10 or more employees	Data from ILO only
Mexico	20	ILO	1992-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers	New methodology from 1995	1989, 1992, 1994, 2010: SEDLAC Other years: ILO
		SEDLAC	1989, even years between 1992-2010	Net earnings	Monthly	Employees	Cleaned, check for outliers		
Moldova	15	ILO	1996-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Establishments with 20 or more employees	Data from ILO only
Mongolia	11	ILO	2000-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Montenegro	4	ILO	2007-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Nepal	1	ILO	1999	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Netherlands	16	ILO	1994-2005	Gross earnings	Monthly Hourly	Employees	Cleaned, check for outliers		- 2002, 2004\3: ILO - Other years: ECHP,

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		EU-SILC
		EU-SILC	2004-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Netherlands Antilles	9	ILO	1991-1998, 2000	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
New Caledonia	1	ILO	1999	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Industry N includes only private workers	Data from ILO only
New Zealand	22	ILO	1989-2010	Gross earnings	Hourly Monthly	Employees	Cleaned, check for outliers	Data for 2009, 2010 are in the monthly basis	Data from ILO only
Nicaragua	6	ILO	2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 2009 - 2010: Data from ILO - Other years: SEDLAC
		SEDLAC	1993, 1998, 2001, 2005	Net earnings	Monthly	Employees	Cleaned, check for outliers		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Nigeria	1	LSMS	2010	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights	Top and bottom 1% drop to remove outliers	Data from LSMS only
Norway	14	ILO	1997-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		-2003-2009: Data from EU-SILC - Other years: ILO
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Panama	17	ILO	1998-1999, 2002-2010	Gross earnings	Hourly Monthly	Employees	Cleaned, check for outliers	- 1998-1999, 2009-2010: Monthly - Other years: Hourly	- 2007 - 2008: ILO - Other years: SEDLAC
		SEDLAC	1989, 1991, 1995, 1997-2007, 2009-2010	Net earnings	Monthly Hourly	Employees	Cleaned, check for outliers		
Paraguay	14	ILO	2007 – 2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 2010: ILO

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		SEDLAC	1990, 1995, 1997, 1999 2001 – 2010	Net earnings	Monthly Hourly	Employees	Cleaned, check for outliers		- Other years: SEDLAC
Peru	14	ILO	2002-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	2002-2008: Salaried employees, urban areas	Data from SEDLAC only
		SEDLAC	1997-2010	Net earnings	Monthly	Employees	Cleaned, check for outliers		
Philippines	15	ILO	1996-2010	Wage rates	Daily	Employees	Cleaned, check for outliers	Before 2001: Establishments with 20 or more persons employed. Before 1999: establishments with 10 or more persons employed.	Data from ILO only
Poland	18	ILO	1993-2008, 2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 2003-2009: EU-SILC - Other years: ILO
		EU-SILC	2004-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Portugal	17	ILO	1998-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Prior to 2002: PTE; 1 Euro = 200.482 PTE	- 2002-2003: ILO - Other years: ECHP, EU-SILC

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
		EU-SILC	2004-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Qatar	5	ILO	2001, 2005-2007, 2009	Wage rates Gross earnings	Monthly	Employees	Cleaned, check for outliers	2001: Gross earnings, total coverage. This data should be treated with care because there seems to be some incompatibility with data from other years 2009: Gross earnings, employees - Other years: Wage rates per month, employees	Data from ILO only
Romania	19	ILO	1992-2007, 2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	From 2005: New denomination: 1 leu = 10,000 old lei.	- 2004-2009: Data from EU-SILC - Other years: Data from ILO

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		EU-SILC	2004-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Russian Federation	10	ILO	1995-1998, 2005-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	1997: New denomination: 1 new ruble = 1,000 old rubles	Data from ILO only
Saint Helena	9	ILO	1994-2002	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Vincent and the Grenadines	11	ILO	1992-2002	Wage rates	Daily	Employees	Cleaned, check for outliers		Data from ILO only
San Marino	6	ILO	2001-2006	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Saudi Arabia	2	ILO	1997, 2009	Gross earnings	Weekly	Employees	Cleaned, check for outliers		Data from ILO only
Serbia	9	ILO	2003-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		2002: LSM Other years: ILO
		LSMS	2002, 2003, 2007	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Serbia and Montenegro	9	ILO	1997-2005	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Prior to 2002: excluding private sector; net earnings.	Data from ILO only
Seychelles	24	ILO	1986-2009	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Slovakia	20	ILO	1991-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	1997: Excluding enterprises with less than 20 employees, 1991-1996: Excluding enterprises with less than 10 employees,	- 2004-2009: EU-SILC - Other years: ILO
		EU-SILC	2004-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Slovenia	26	ILO	1985-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers	- 2005: Beginning 2005, methodology revised: excluding family allowances and the value of payments in kind. 2Prior to 2007: SIT; 1 Euro = 239.64 SIT.	- 2004-2009: EU-SILC - Other years: ILO

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		EU-SILC	2004-2010	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
South Africa	10	National data archive: SADA	1997-1999, 2002-2008	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		- Data from SADA only
South Korea	16	ILO	1993-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Establishments with 10 or more regular employees, figures in thousands	- 2006: LIS - Other years: ILO
		LIS	2006	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Spain	17	ILO	1996-2009	Gross earnings	Monthly Hourly	Employees	Cleaned, check for outliers	- 2009: Monthly basis - Other years: Hourly - Prior to 1999: ESP; 1 Euro = 166.386 Pesetas	- 2002-2003: ILO - Other years: ECHP, EU-SILC
		ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
		EU-SILC	2004-2010	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Sri Lanka	2	ILO	2009-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Suriname	1	SEDLAC	1999	Net earnings	Monthly	Employees	Cleaned, check for outliers		Data from SEDLAC only
Sweden	17	ILO	1993-2007	Gross earnings	Hourly	Wage earners	Cleaned, check for outliers	Combination of ILO data with other data is not advisable because the ILO data only cover wage earners, i.e. low	- 1993-1997, 2002: ILO - Other years: ECHP, EU-SILC
		ECHP	1997-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		EU-SILC	2003-2009	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights	skill workers	
Switzerland	9	ILO	1994, 2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers	Data for even years only	Data from ILO only
Taiwan	8	ILO	2004-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 1995, 1997, 2000, 2005: LIS - Other years: ILO
		LIS	1995, 1997, 2000, 2005	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
Tajikistan	10	ILO	2000-2007	Gross earnings	Monthly	Employees	Cleaned, check for outliers		- 1999, 2003, 2007, 2009: LSMS - Other years: ILO
		LSMS	1999, 2003, 2007, 2009	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Tanzania	3	National data archive: TNADA	2001, 2008, 2010	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		
Thailand	8	ILO	2001-2008	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Turkey	13	ILO	1993-2005	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Uganda	5	Obtained via database: http://openmicrodata.wordpress.com/	1999, 2002, 2006	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		- 1999, 2002, 2006: Data from openmicrodata only - 2009, 2010: Data from LSMS

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
			2009, 2010	Net earnings	Monthly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		
Ukraine	16	ILO	1995-2010	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
United Kingdom	25	ILO	1986-2010	Gross earnings	Monthly Hourly	Employees	Cleaned, check for outliers	- 1986-2003: Hourly basis -1998-2008: Weekly basis	- Before 2004: ILO - 2004-2010: EU-SILC
		ECHP	1994-2001	Gross earnings	Monthly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
		EU-SILC	2004-2010	Gross earnings	Yearly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
		National data archive: UK data archive	1995-2010	Gross earnings	Weekly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		
United States	22	National data archive: CPS	1990-2011	Gross earnings	Weekly	Employees	- Employees with positive income are retained - Estimate average industrial wages using relevant weights		Data from CPS only
Uruguay	17	SEDLAC	1989, 1992, 1995-2010	Net earnings	Monthly	Employees	Cleaned, check for outliers		Data from SEDLAC only
Uzbekistan	6	ILO	1994-1999	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only
Venezuela	18	SEDLAC	1989, 1992, 1995, 1997-2011	Net earnings	Monthly	Employees	Cleaned, check for outliers		Data from SEDLAC only
Vietnam	6	National data archive: GSO	1993, 1998, 2002, 2004, 2006, 2008	Net earnings	Yearly	Employees	- Employees with positive income are retained - Payment in non-monthly basis is converted to monthly basis - Bonus, payment in kind are included - Top and bottom 1 percent dropped - Estimate average industrial wages using relevant weights		Data from GSO only
West Bank & Gaza Strip	14	ILO	1996-2009	Gross earnings	Daily	Employees	Cleaned, check for outliers		Data from ILO only

Country	Obs	Source	Years	Wage concept	Time basis	Coverage	Applied Procedures	Notes	Combined dataset
Zimbabwe	1	ILO	2009	Gross earnings	Monthly	Employees	Cleaned, check for outliers		Data from ILO only

Chapter 3
Measuring government wages: Invalidating the macro data approach

3.1 Introduction[1]

Empirical economists have to accept the inconvenient truth that data are measured with errors. Data on government wages are no exception. They have commonly been obtained by imputation, using data at the macro level. That is, the government wages are calculated by dividing the government wage bill by the total government employment (Holm-Hadulla et al., 2010; La Porta et al., 1999; Lamo et al., 2012; Lane, 2003; Schiavo-Campo et al., 1997; Van Rijckeghem and Weder, 2001). While the wage bill from national accounts data has been found to be unreliable in some countries (Bloem et al., 1998), it is in particular the measurement of government employment that has been proven to be notoriously difficult in any country. This is due to the presence of part time, part year and casual workers (Heller and Tait, 1984; Lamo et al., 2012; Schiavo-Campo et al., 1997). Little can be said therefore about the reliability of imputed government wages. They may be unbiased, but they may also be seriously biased upward or downward, depending on the magnitude of the errors in the data for the wage bill and employment.

Despite this uncertainty about the quality of the data, a large and increasing number of studies still utilize this macro data approach to impute government wages. Although most authors acknowledge the limitations of the data on government wages and employment as well as the possible consequences for their empirical findings (Lamo et al., 2012; Schiavo-Campo, 1998), no research has been devoted to uncovering this methodological problem. In this chapter, we focus on the bias of government wages as computed from macro data. We use a large number of nationally representative and internationally harmonized household survey micro datasets to obtain unbiased estimates of the government wages. These are used as a benchmark to validate the government wages as computed from macro data.

The literature on survey methodology shows that estimates from micro household survey datasets are unbiased as long as the surveyed samples are random and representative (Lohr, 2010). A large body of survey validation literature indeed reports that household survey data yield unbiased estimates of the true wages (Akee, 2011; Bound et al., 2001; Kapteyn and Ypma, 2007).

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[1] This chapter is based on Le, V.H., Dietzenbacher, E., de Haan, J., 2013. Measuring government wages: invalidating the macro data approach. University of Groningen, The Netherlands.

One obstacle to our validation approach is that national household surveys often employ a less comprehensive concept of wages than the concept used in macro databases. Wages in the national accounts as well as in international databases—such as the International Monetary Fund's Government Finance Statistics (GFS) or the OECD.Stat database—are defined as gross total earnings, in cash and in kind, that are paid to employees in a given period of time. In contrast, household surveys often capture less comprehensive concepts such as net earnings (i.e. total earnings less tax), earnings in cash, or basic monthly salaries. To overcome this obstacle, we have used data from the European Union's project "Statistics on Income and Living Conditions" (EU-SILC). It reports gross total earnings in cash and in kind at the individual level for 32 countries (27 EU member countries, plus Croatia, Iceland, Norway, Switzerland and Turkey). Also the United States is included in our analysis, using comparable data from the Current Population Survey (CPS).

Our results—based on 98 observations from 17 countries—show that the macro data approach overestimates the government wages in 11 countries. Underestimation is found for 2 countries and only in the remaining 4 countries does the macro data approach produce reasonable estimates of the government wages. We also find that the magnitude of the bias of the macro data approach is country specific and remains relatively stable over time. Our findings not only have implications for studies on government wages at the national level but also for studies that examine or use imputed wages at other levels (e.g. regions, industries, household groups). The chapter proceeds as follows. Section 3.2 presents the motivation for this research. Section 3.3 describes the data sources. Section 3.4 offers the results, while Section 3.5 concludes.

3.2 Motivation

In many countries, the government is the largest employer. Research questions related to the remuneration policies of governments have therefore received due attention in the literature. For example, how do governments differ across countries in terms of wages and remuneration policies and what are the determinants of such differences (Heller and Tait, 1984; Schiavo-Campo, 1998)? Other examples include the influence of government wage policies on government efficiency, public sector quality and government corruption (La Porta et al., 1999; Panizza et al., 2001; Treisman, 2000; Van Rijckeghem and Weder, 2001). More recently, a new line of literature examined the effect of government remuneration policies on private sector wages and, thus, the general price level (Afonso and Gomes, 2011; Lamo et al., 2012; Pérez and Sánchez, 2011).

Table 3.1 presents an overview of studies in which data for government wages were created.[2] Three observations stand out. First, the studies surveyed focus on different levels of government, namely the public sector, the general government sector, the central government, and the public administration sector. Second, the time and country coverage of these studies is rather limited. Except for the most recent studies on OECD countries, this limitation applies especially to developing countries. Third, and most importantly, studies on government wages have followed the macro data approach laid down by Heller and Tait

[2] This table only includes papers in which a data set was created, not the papers that used one of these data sets (such as Herzfeld and Weiss, 2003; La Porta et al., 1999 and Treisman, 2000).

(1984). The average annual government wages are imputed by dividing the government wage bill by the corresponding total government employment. The only exception—to the best of our knowledge—is Panizza et al. (2001) who employ micro survey data in earnings regressions to estimate the government wage premium.

Reviewing the literature, we also find that research which uses the datasets listed in Table 3.1 has yielded limited and controversial results. This holds in particular with regards to the impact of government wages on government efficiency and corruption (Treisman, 2007). It is tempting to extent these studies by employing new data that have become available from databases by the IMF, OECD and the International Labor Organization (ILO). However, we feel it is essential to first investigate the current practice of imputing the average government wages. That is, to examine whether it provides data that are sufficiently reliable to support further research.

Table 3.1. Summary of studies that created data

Author	Coverage	Level of Government	Wage Concept	Research Question	Number of observations
Using the macro approach:					
Heller and Tait (1984)	50 countries between late 1970s & early 1980s	Central/general government	Annual wages and salaries	Assess the structure of public sector pay	About 50
Schiavo-Campo et al. (1997)	All countries in the early 1990s	Central government	Annual wages and salaries	Assess the adequate of public sector pay	About 90
Goel and Nelson (1998)	All states in the United States	Public sector	Annual wages and salaries	The impact of government wages on corruption	About 240
Van Rijckeghem and Weder (2001)	30 developing countries (1986-1994)	General government	Annual wages and salaries	The impact of government wages on corruption	About 168
Lane (2003)	OECD countries (1970-1998)	General Government	Annual employee compensation	The cyclical behavior of government Consumption	About 28 per country
Afonso and Gomez (2011)	OECD countries (1975-2006)	General government	Annual employee compensation	Interaction between public and private wages	About 400
Gaetano (2011)	Easter and Central European countries	Public administration	Quarterly employee compensation	Interaction between public and private wages	About 40 per country
Perez and Sanchez (2011)	OECD countries (1991-2007)	General government	Quarterly employee compensation	Signaling role of government wages to private wages	About 64 per country
Lamo et al. (2012)	OECD countries (1975-2006)	General government	Annual employee compensation	Interaction between public and private wages	About 36 per country
Using micro survey data:					
Panizza (2001)	Latin America (1993-1998)	Public sector	Net monthly earnings	The impact of government wages on corruption/government efficiency	About 60

3.2.1 The possible bias of the macro data approach

The macro data approach computes the average government wages as the ratio of the government wage bill to total government employment. Potential biases therefore occur both in the numerator and in the denominator. First, the government wage bill may not be recorded correctly (or inconsistently across time and space). Many non-monetary benefits—such as travel, housing and other allowances—can be recorded as spending under other goods and services. In a similar fashion, payments to employees in government projects can be recorded as capital spending and outlays for temporary workers are in some countries classified as use of goods and services (Clements et al., 2010). In general, a number of spending categories should be included in the government wage bill but they are often mistakenly excluded (i.e. recorded somewhere else).

Second, creating government employment data that are consistent over time and across countries is notoriously difficult. Issues to cope with include full time versus part time workers and full year versus part year employment. Some employees work full time for the whole year but others may work part time and only for a fraction of the year. In addition, casual workers—who work on contingent government projects—may account for a substantial proportion of government employment during some periods (Klitgaard, 1989). The key problem is that there is no agreed international standard on how to combine these different types of government employment into a single figure. An issue that applies to some developing countries is that government employment is inflated by fictitious workers who only exist in the books (Clements et al., 2010).

The imputed average annual government wages can thus be biased upward or downward, depending on the precision of the statistics in a country. The changes in annual government wages within a country may simply reflect changes in the statistical methods employed rather than actual changes. When such measurement errors are not random, empirical conclusions can be rendered unreliable.

3.2.2 Why should micro survey data be used as an appropriate benchmark?

Survey data in general and survey data on wages and salaries in particular also suffer from measurement errors. A large body of literature on survey data validation has been devoted to analyzing the characteristics of errors in the reported wages (Akee, 2011; Bollinger, 1998; Bound et al., 2001; Bound and Krueger, 1991; Duncan and Hill, 1985; Pischke, 1995). These studies compare survey data on gross earnings with administrative data such as social security records or employer records. Both for developed and developing countries, the survey errors have been found to center around zero and to be mean reverting. Mean reversal occurs when people at the higher end of the income distribution underreport their income while people at the lower end of the distribution over-report their income. Based on this finding, let the self-reported survey wages and salaries of individual *j* be given by X_j. We assume

$$\boldsymbol{X_j = X_j^* - \delta\left(X_j^* - \bar{X}^*\right) + \varepsilon_j}$$

where X_j^* gives the true wages and salaries for surveyed individual *j*, $\bar{X}^*$ is the population mean of true wages and salaries, and ε_j is white noise centered around 0. The term $\delta\left(X_j^* -\right.$

$\bar{X}^*\big)$, with $\delta > 0$, captures the mean reversal of the errors. Suppose that a nationally representative sample of n government employees is collected via a survey. The sample mean of the government wage rate is $\bar{X} = \sum_{i=1}^{n} X_i \,/n$ and its expected value is

$$\begin{aligned} \boldsymbol{E(\bar{X})} &= \left\{ \frac{\mathbf{1}}{\boldsymbol{n}} \sum_{\boldsymbol{i=1}}^{\boldsymbol{n}} \left[\boldsymbol{X_j^*} - \boldsymbol{\delta}\left(\boldsymbol{X_j^*} - \boldsymbol{\bar{X}^*} \right) + \boldsymbol{\varepsilon_j} \right] \right\} \\ &= \frac{\mathbf{1}-\boldsymbol{\delta}}{\boldsymbol{n}} \sum\nolimits_{\boldsymbol{i=1}}^{\boldsymbol{n}} \boldsymbol{E(X_j^*)} + \boldsymbol{\delta \bar{X}^*} + \frac{\mathbf{1}}{\boldsymbol{n}} \sum\nolimits_{\boldsymbol{i=1}}^{\boldsymbol{n}} \boldsymbol{E(\varepsilon_j)} \\ &= \frac{\mathbf{1}-\boldsymbol{\delta}}{\boldsymbol{n}} \boldsymbol{n \bar{X}^*} + \boldsymbol{\delta \bar{X}^*} = \boldsymbol{\bar{X}^*} \end{aligned}$$

where we have used that the sample is representative, i.e. $E\left(X_j^*\right) = \bar{X}^*$, and that the errors center around zero, i.e. $E\left(\varepsilon_j\right) = 0$.

The sample mean of the government wages in the survey is therefore an unbiased estimator of the population mean. This theoretical result, which rests on certain assumptions, has been corroborated empirically in various survey validation studies (see Bound et al., 2001, for a survey). Reviewing this literature, we find that in most studies the mean wages and salaries differ just a few percent between the survey and the administrative records. In a more recent study, Akee (2011) finds that the average self-reported earnings in the Federal State of Micronesia are only about 3% smaller than the average from administrative records in 1993 and the two averages are almost equal in 1999. Kapteyn and Ypma (2007) challenged the mean reversal of the errors for reported wages and salaries from a survey, arguing that also administrative records contain errors. Still, they find that the average wages and salaries reported in a survey for Sweden in 2003 are 2% smaller than the corresponding mean from administrative data.

The finding that survey validation studies always report that the mean wages and salaries in survey and administrative data are close to each other suggests that mean wages from survey data are an unbiased estimator of the mean wages from administrative data. Therefore, we use the average government wages from household surveys as a benchmark to validate the government wages computed from macro data sources.

3.3 Data

3.3.1 Microdata

The biggest challenge for our research is to find nationally representative survey datasets that provide data on wages that are comparable to the definition of wages provided in macroeconomic databases. In most countries, survey data often provide only some components of wages and salaries, such as net earnings, basic wage rates or a combination of basic wage rates and some other components like overtime payment or bonuses. Fortunately, the European Union's "Statistics on Income and Living Conditions" (EU-

SILC) database and the Current Population Survey (CPS, March Supplementary files) from the United States provide data that allow us to carry out this validation exercise.

The EU-SILC database results from a harmonized framework by the 27 EU member countries plus Croatia, Iceland, Norway, Switzerland and Turkey to collect comprehensive data on income and living conditions (Clemenceau and Museux, 2007). We have used the cross sectional EU-SILC data from the first 7 rounds of the project, which took place between 2004 and 2010. In total, 177 datasets from 29 countries were obtained. Data for Croatia, Switzerland and Turkey are not available because these countries only participated in the most recent rounds.

The EU-SILC project is an open framework that gives substantial freedom to national statistical offices to design their own sample. For each country, four different nationally representative subsamples are surveyed in a certain year. In the following year, one subsample is dropped and replaced by a completely new subsample. Each subsample is therefore included in the survey for four years.[3] This design implies that the overall sample is representative and annually updated.

EU-SILC focuses on different socio-economic characteristics of the surveyed individuals. For our research, however, the relevant questions are those about industry of work and total income in cash and in kind. The survey in a given year t, provides for each individual the following information: the industry of work in year t according to the International Standard of Industrial Classification of Economic Activities, Revision 3 (ISIC 3); the total wages and salaries in cash and in kind from work in year t-1; and whether an individual had a second job in year t-1. Using information that is available on a monthly basis, it is also known whether an individual changed jobs during the last 12 months. The wage concept used in the EU-SILC surveys is comparable with the definition of wages and salaries as used in macro databases.

One drawback is that the EU-SILC database contains no information whether someone is working for the government. This prevents us from estimating the annual wages of government employees at different government levels. We focus therefore on the ISIC 3 industry "Public administration and defense; compulsory social security" (indicated as public administration hereafter). The next section compares the micro and macro approach also for other industries.

Our calculation of the wages in public administrations involved several steps. First, only individuals who work for the public administration industry are included. Second, public administration employees who report that they have changed their job since last year were dropped because their reported wages and salaries were earned in their previous job. Third, individuals who report that they had a second job were also dropped because their wages and salaries may contain income that is not earned in public administration. Fourth, some countries do not report data on whether an individual had a second job. If that information is not available, the whole dataset of that year is dropped. As a result, only 134 datasets in the EU-SILC database have been used.

[3] During the start-up period some subsamples are included less than four years.

In the final step, our micro-based estimates of annual government wages are obtained as the weighted averages of the gross annual earnings of the remaining individuals in the full sample (i.e. including all four subsamples). The weight is the probability that an individual is selected for the sample and reflects the population characteristics. The resulting government wages are the average wages of all individuals working for the public administration industry, who have positive wages and salaries. It should be emphasized that the nature of the work contract is not taken into account. Consequently, an individual receives a certain weight no matter whether (s)he works part time or full time.

The proportion of public administration employees who have a second job or who have changed their job since last year is negligible in our data. As a robustness check, we have also estimated the government wages for the full sample (i.e. including also people with extra jobs and those who changed jobs). It turns out that our conclusions in the next section remain unchanged. The results are available upon request.

The CPS is conducted monthly by the US Department of Labor and is representative for the whole population in the United States. Different from the EU-SILC data, the CPS only provides data on gross weekly earnings from the main job. For our study, we retain only individuals who work for the public administration industry and estimate the mean weekly wages for this subsample. The annual government wages are computed as the weekly wages multiplied by 52. This practice results in an underestimation of the annual wages if public administration employees enjoy non-regular earnings that are not captured in the weekly earnings. In the next section, we will discuss that this does not undermine our general conclusion for the US.

3.3.2 Macro data

Our macro data are taken from the OECD Structural Analysis (STAN) database. The STAN database provides data on the wage bill and employment for ISIC 3 industries in 33 OECD countries from the early 1990s onwards and is updated regularly. The data come from the national accounts of the member countries. The macro average annual government wages (or STAN macro wages) are computed by dividing the wage bill by the number of employees in public administration. All countries included in the STAN database use head counts as the measure of employment. The macro data are thus in line with the micro data in the sense that no distinction is made between full time and part time workers. Some countries, however, also provide full time equivalent units. For these countries, we are therefore able to compute the corresponding full time equivalent annual government wages.

STAN data are in the national currency while all EU-SILC data are in euros. To make a comparison possible, the STAN data on the wage bill are converted to Euros using the average annual exchange rates as obtained from Eurostat. This is done for all countries not in the Euro area, except the United States (for which both macro and micro data are in current US dollars).

3.4 Results

The final sample consists of 101 observations from 20 countries. The reduction of the sample size is due to the fact that some countries are included in the STAN database but not in the EU-SILC database, and vice versa. All observations fall in the period 2003-2009,

except the annual series for the United States which spans 1998-2009. For most countries we have more than one observation except for Finland, Greece and Portugal. The list of countries and years that have been used in our study are listed in Appendix 3.A.

3.4.1 The main results

The macro and micro wages are difficult to compare because the wage levels differ substantially across countries. To ease the comparison of the macro and micro wages and highlight the bias of the macro data, we divide the macro government wages by the micro government wages. The resulting ratios are summarized in Table 3.2 and the details by country and year are given in Appendix 3.B.

Table 3.2. Summary of the ratio of macro to micro government wages

Country	Observations	Mean	Standard Deviation	Min	Max
Austria	7	0.99	0.05	0.93	1.09
Belgium	5	1.00	0.04	0.96	1.04
Czech Republic	6	1.20	0.03	1.16	1.23
Denmark	7	1.30	0.07	1.20	1.40
Estonia	7	1.19	0.10	1.09	1.36
Finland	1	0.82	-	-	-
France	5	1.09	0.05	1.02	1.15
Germany	5	0.94	0.02	0.91	0.97
Greece	1	1.03	-	-	-
Hungary	5	1.44	0.08	1.36	1.54
Ireland	3	1.24	0.02	1.22	1.25
Italy	4	1.06	0.03	1.04	1.10
Luxembourg	7	1.10	0.02	1.08	1.14
Netherlands	6	0.89	0.02	0.87	0.92
Poland	4	1.07	0.02	1.05	1.11
Portugal	1	1.13	-	-	-
Slovakia	6	1.81	0.20	1.64	2.09
Slovenia	6	1.09	0.01	1.07	1.11
Spain	3	0.96	0.04	0.94	1.01
United States	12	0.93	0.03	0.90	1.01

Although the average micro government wages are unbiased estimates of the true population mean of the government wages, they still contain sampling errors. When the sample—for a given country in a given year—would be repeated a large number of times, the average micro government wages will follow a normal distribution with the true average government wages as its mean. If the macro approach uses the same definition for the government wages and if the macro wages do not include measurement errors, they also reflect the true population mean. In that case, the macro and micro wages must—for individual years—be approximately the same and the macro-micro ratios will oscillate around 1. If the macro-micro ratio is consistently larger (smaller) than 1, the macro data

approach overestimates (underestimates) the true population mean of the government wages. This is because the micro data approach yields an unbiased estimate (i.e. only contains random sampling errors). If macro and micro data use the same wage definition, a macro-micro ratio that is consistently larger (or smaller) than 1 suggests the occurrence of systematic measurement errors in the macro approach. For example, it may be the case that a country's statistical practices lead to errors in the measurement of the wage bill and/or total government employment. Because statistical practices are often in place for some time, the error is likely to remain from one year to another.

The results in Table 3.2 show that the macro data approach performs relatively poor for most of the 20 listed countries. It only produces good estimates of government wages for Austria, Belgium, and—to a lesser extent—Spain and the US. For these countries we find that the smallest observation is below 1 and the largest above 1. For the remaining countries we find that the macro wages are persistently too high for 11 countries and persistently too low for two countries, while for three countries we only have one observation.

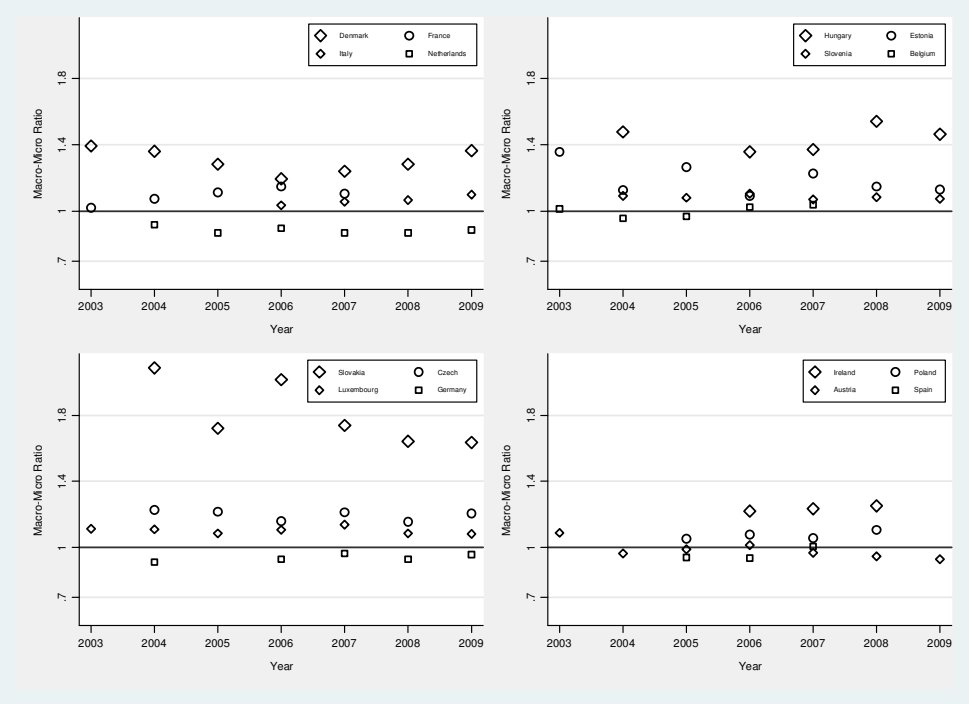

Figure 3.1. The distribution over time of the ratio of the macro to the micro government wages by country

In the case of overestimation of the government wages, the mean macro-micro ratio varies from 1.06 to 1.81. Slovakia is the most extreme with an overestimation that ranges over the years from 64 to 109%. Hungary, Denmark, Ireland, the Czech Republic and Estonia are other countries in which the estimates with macro data approach are more than 15% larger than those with the micro approach. Slovenia, Poland, France, Italy and Luxembourg are

countries with a relatively low—but persistent—overestimation of less than 10%. The Netherlands and Germany are the only countries where the macro approach persistently underestimates the government wages. On average, the macro wages are 11% too low in the Netherlands and 6% in Germany. Finland, Greece and Portugal only have one observation because information on a second job is not available for other years. The macro-micro ratio is quite close to 1 for Greece, larger than 1 for Portugal, and smaller than 1 for Finland.

For the Unites States, we find a macro-micro ratio that is smaller than 1 in 11 out of the 12 years of observation (the exception is 1.01 in 2007). It should be emphasized that the micro data for the US are not annual figures. Instead, the annual government wages have been computed from weekly gross earnings that were multiplied by 52. This practice may fail to include non-regular payments, in which case the micro government wages have a negative bias. If the macro approach contains no measurement errors, the imputation procedure would provide the correct government wages. In that case, we would expect to find that the calculated micro wages are smaller than the calculated macro wages. Clearly, this is not the case. The macro government wages are lower than the micro wages, which indicates that the macro data approach underestimates the government wages for the United States.

Figure 3.1 graphs the macro-micro ratio over time and illustrates the persistence of the bias of the macro data approach. For instance, the ratio for Hungary fluctuates around 1.5 suggesting that the macro data approach overestimates the government wages by about 50%. In a similar manner, the ratio for the Netherlands oscillates around 0.9 suggesting that the macro wages underestimate the government wages by about 10%. The worst case is Slovakia, which has all data points above 1.6.

3.4.2 Extension to other industries

The results above indicate that the macro data approach fails to produce precise estimates of government wages. In the literature, macro data sources have been used to impute the average wages at the industry level (Genre, 2011; Gittleman and Wolff, 1993). Therefore, we extend our comparison in this section to other ISIC 3 industries. The classification in the EU-SILC and the STAN database are the same if some of the ISIC 3 industries are aggregated. The industries covered in our analysis are: Agriculture, hunting and forestry, and Fishing (ISIC 3 industries A+B); Mining and quarrying, Manufacturing, Electricity, gas and water supply (C+D+E); Construction (F); Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods (G); Hotels and restaurants (H); Transport, storage and communications (I); Financial intermediation (J); Real estate, renting and business activities (K); Education (M); Health and social work (N).[4] For each industry, the macro wages have been computed using the data from the STAN database and the micro wages were estimated from the EU-SILC database, in the same manner as the government wages were estimated. Next, the ratio of macro to micro wages was computed for each industry. Appendix 3.C gives the detailed results and Table 3.3 provides a summary.

[4] Public administration and defense; compulsory social security is industry L and was dealt with in the previous subsection.

Table 3.3. The ratio of the macro to the micro wages by country and by industry

Country	A-B	C-E	F	G	H	I	J	K	M	N
Austria	0.81	1.20	1.09	1.08	1.28	1.00	1.14	0.95	1.05	1.01
Belgium	0.70	1.03	1.01	1.14	1.09	1.02	1.15	0.90	1.09	1.04
Czech Republic	1.00	1.09	1.01	1.22	1.05	1.08	1.45	1.07	1.19	1.16
Denmark	0.85	1.07	1.18	0.96	0.84	1.00	1.08	0.95	1.06	0.98
Estonia	0.98	1.03	0.86	1.31	1.01	0.97	1.36	1.61	1.07	1.18
Finland	1.35	1.03	1.28	0.95	1.07	0.98	0.98	1.21	1.09	1.07
France	0.99		1.20	1.23	1.38	1.10	1.30	1.19	1.15	1.09
Germany	0.87	1.05	0.93	1.05	1.07	0.90	0.99	0.89	1.02	1.02
Greece	1.56	1.09	0.73	1.21	1.24	1.04	1.26	1.28	1.12	1.22
Hungary	1.37	1.27	1.18	1.67	1.32	1.44	1.59	2.22	1.09	1.49
Ireland	0.93	1.05	1.48	1.20	1.26	1.27	1.22	1.03	1.33	1.47
Italy	1.05	0.98	0.95	1.03	1.54	1.25	1.14	0.94	0.98	0.94
Luxembourg		0.88	0.96	1.06	0.88	0.90	1.04	0.88	1.04	0.98
Netherlands	0.93	0.92	0.98	0.88	0.78	0.97	0.98	0.73	1.02	0.86
Poland	1.59	1.07	1.01	1.26	1.18	0.98	1.01	1.46	1.11	0.99
Portugal	0.89		1.07	1.06	1.00	1.15	1.13	0.92	1.06	1.11
Slovakia	1.32	1.47	1.28	1.62	1.31	1.43	2.14	1.50	1.24	1.36
Slovenia	1.07	1.10	1.07	1.20	1.24	1.17	1.07	1.25	1.01	1.08
Spain	0.80	1.04	1.12	1.03	1.35	1.01	1.44	1.25	1.14	1.23
United States		1.21	1.11	1.18	0.71	1.14	1.52	1.21	0.96	1.11

We find that the inadequacy of the macro data approach for deriving the average wages is also present in industries other than public administration. Observe, however, that the pattern of the bias of the macro approach is not the same within a country. For example, the macro data approach underestimates for Austria the average wages for real estate (K), produces good estimates for health and social work (N), but leads to overestimation for hotels and restaurants (H). For most countries we find industries macro-micro ratios that are persistently larger than 1 as well as industries with ratios persistently smaller than 1. This indicates that the systematic errors in the macro approach do not—within a country—have the same sign across industries. If the macro data in a certain country persistently fail to capture some wage or employment component in one industry, this does not need to apply to another industry. Finally, observe that France, Hungary and in particular Slovakia are the exceptions, i.e. in these countries the macro approach almost always overestimates the average industry wages.

3.4.3 Is the bias only due to employment statistics?

The macro approach calculates the average government wages by dividing the government wage bill by total government employment. It has been argued (Heller and Tait, 1984; Schiavo-Campo et al., 1997) that the macro data for government employment are highly problematic, whereas the data for the wage bill are much more reliable. In that case, the poor quality of the employment statistics would be the most important cause for the bias in estimating the government wages. In particular, inadequate measurement of part time and part year workers may cause this bias. Our micro data allow us to provide some additional insight into these issues.

Recall that both the macro and the micro data that led to the results in Table 3.2 and Figure 3.1 adopted the head counts method. That is, no distinction was made whether an employee worked full time or part time. As a robustness check we have also focused on full time

equivalent wages. The full time equivalent macro government wages from the STAN database are obtained by dividing the government wage bill by total government employment in full time equivalent units. Unfortunately, this is only possible for a few countries and years because data on full time equivalent employment are largely missing in the STAN database. The micro full time government wages are estimated as the mean wages and salaries of individuals who reported that they worked full time, full year in the income reference period. The results (which are available upon request) for these full time equivalent wages show that the bias remains almost the same as for the case with data based on the head counts method. For some observations, the overestimation seems to be even larger.

Next, suppose that the government wage bill is determined correctly so that the bias from using the macro approach is due to the employment data. Suppose further that the macro employment data are flawed because part time and part year employment is incorrectly taken into account. In that case, one would expect the error to be larger for countries and years that have a larger share of total government employment for part time and part year work. Let the error be measured by the absolute difference of the macro-micro ratio from 1. One would thus expect that the error be positively correlated with the share of part time and part year work. Using the EU-SILC database we have calculated the share of public administration employees who report that they had a temporary contract or worked part time during the income reference period. In contrast to the expectation, this share correlates negatively with the errors (although the correlation coefficient is not significantly different from zero at the 10% level).

Our results cannot fully answer the question of what causes the bias of the macro approach. However, they clearly point out that the failure—in the employment statistics—to take part time and part year employment appropriately into account cannot be the sole cause of the bias.

3.5 Conclusion

Based on a large number of high-quality household survey micro datasets, we have calculated the average wages (which are known to be an unbiased estimate of the true population average) in public administration. The method that is commonly used is the macro approach. It arrives at the average government wages by imputation using macro data, i.e. by dividing the government wage bill by government employment. Comparing the outcomes, we find serious discrepancies between the micro and macro results. Given the unbiasedness of the micro wages, this indicates that government wages computed from macro data sources are not reliable. Because the macro data approach has been widely applied in empirical research, this may have important consequences for the results.

For some countries, the macro government wages are lower than the micro wages while the opposite is true for other countries. Only in a few countries are the macro government wages in line with the micro wages. The bias varies from one country to another but appears to be relatively constant over time within each country. Similar findings also hold for other industries than the public administration industry. It should be stressed that our results are based on a sample of OECD countries whose statistical systems are well developed.

Previous studies often mentioned the difficulties in measuring government employment as a potential source of error for the macro approach because of the presence of part time and part year government employees. However, our results indicate that the problem is not only caused by inappropriately measuring employment, suggesting that there are also errors in the data for the government wage bill.

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3.7 Appendices

3.7.1 Appendix 3.A. Countries and years in the final sample

Country	Observations	Time span	Country	Observations	Time span
Austria	7	2003-2009	Ireland	3	2006-2008
Belgium	5	2003-2007	Italy	4	2006-2009
Czech Republic	6	2004-2009	Luxembourg	7	2003-2009
Denmark	7	2003-2009	Netherlands	6	2004-2009
Estonia	7	2003-2009	Poland	4	2005-2008
Finland	1	2004	Portugal	1	2006
France	5	2003-2007	Slovakia	6	2004-2009
Germany	5	2004-2009	Slovenia	6	2004-2009
Greece	1	2009	Spain	3	2005-2007
Hungary	5	2004-2009	United States	12	1998-2009

3.7.2 Appendix 3.B. Comparison of results for government wages

Country	Year	Macro government wages	Micro government wages	Ratio of macro to micro government wages	Country	Year	Macro government wages	Micro government wages	Ratio of macro to micro government wages
Austria	2003	29776	27365	1.09	Ireland	2008	60006	47901	1.25
Austria	2004	30195	31270	0.97	Italy	2006	32259	31145	1.04
Austria	2005	31041	31382	0.99	Italy	2007	32861	31081	1.06
Austria	2006	32124	31600	1.02	Italy	2008	34923	32724	1.07
Austria	2007	33307	34370	0.97	Italy	2009	35455	32261	1.10
Austria	2008	33887	35804	0.95	Luxembourg	2003	50818	45574	1.12
Austria	2009	35095	37751	0.93	Luxembourg	2004	53163	47863	1.11
Belgium	2003	30342	29934	1.01	Luxembourg	2005	55052	50708	1.09
Belgium	2004	31148	32476	0.96	Luxembourg	2006	57782	52119	1.11
Belgium	2005	32613	33634	0.97	Luxembourg	2007	60352	52938	1.14
Belgium	2006	33541	32707	1.03	Luxembourg	2008	61816	56864	1.09
Belgium	2007	34130	32854	1.04	Luxembourg	2009	63481	58582	1.08
Czech Republic	2004	8842	7203	1.23	Netherlands	2004	33002	35932	0.92
Czech Republic	2005	10237	8400	1.22	Netherlands	2005	33264	38265	0.87
Czech Republic	2006	11376	9799	1.16	Netherlands	2006	34555	38499	0.90
Czech Republic	2007	12437	10242	1.21	Netherlands	2007	35885	41298	0.87
Czech Republic	2008	14446	12472	1.16	Netherlands	2008	37426	43074	0.87
Czech Republic	2009	14154	11734	1.21	Netherlands	2009	37962	42762	0.89
Denmark	2003	50799	36399	1.40	Poland	2005	9005	8536	1.05
Denmark	2004	51129	37526	1.36	Poland	2006	9543	8848	1.08
Denmark	2005	51960	40465	1.28	Poland	2007	10373	9807	1.06
Denmark	2006	53714	44903	1.20	Poland	2008	12592	11368	1.11
Denmark	2007	54937	44260	1.24	Portugal	2006	18859	16653	1.13
Denmark	2008	58032	45214	1.28	Slovakia	2004	9450	4527	2.09
Denmark	2009	64286	47122	1.36	Slovakia	2005	10176	5918	1.72
Estonia	2003	7586	5588	1.36	Slovakia	2006	11907	5913	2.01
Estonia	2004	7771	6893	1.13	Slovakia	2007	12388	7127	1.74
Estonia	2005	8560	6760	1.27	Slovakia	2008	13968	8512	1.64
Estonia	2006	9155	8388	1.09	Slovakia	2009	14708	8995	1.64
Estonia	2007	11434	9304	1.23	Slovenia	2004	18917	17337	1.09
Estonia	2008	13811	12018	1.15	Slovenia	2005	19659	18172	1.08
Estonia	2009	13153	11639	1.13	Slovenia	2006	20644	18665	1.11
Finland	2004	26168	31932	0.82	Slovenia	2007	21353	19960	1.07
France	2003	24619	24115	1.02	Slovenia	2008	23652	21766	1.09
France	2004	25789	24004	1.07	Slovenia	2009	24661	22933	1.08
France	2005	26283	23584	1.11	Spain	2005	21149	22453	0.94
France	2006	27098	23596	1.15	Spain	2006	22805	24299	0.94
France	2007	28015	25294	1.11	Spain	2007	24746	24551	1.01
Germany	2004	29227	32031	0.91	United States	1998	32775	36147	0.91
Germany	2006	29313	31563	0.93	United States	1999	33976	36876	0.92
Germany	2007	29472	30509	0.97	United States	2000	35234	38550	0.91
Germany	2008	30159	32429	0.93	United States	2001	36408	40578	0.90
Germany	2009	31247	32539	0.96	United States	2002	38321	41055	0.93
Greece	2009	26697	25867	1.03	United States	2003	40305	44552	0.90
Hungary	2004	10486	7093	1.48	United States	2004	42219	46900	0.90
Hungary	2006	11267	8290	1.36	United States	2005	44185	47442	0.93
Hungary	2007	12956	9447	1.37	United States	2006	45715	48020	0.95
Hungary	2008	15204	9855	1.54	United States	2007	47787	47547	1.01
Hungary	2009	11923	8136	1.47	United States	2008	49630	52089	0.95
Ireland	2006	52442	42966	1.22	United States	2009	51039	51975	0.98
Ireland	2007	57032	46132	1.24					

3.7.3 Appendix 3.C. Comparison of results for other industries

Country	Year	A-B	C-D-E	F	G	H	I	J	K	M	N
Austria	2003	0.69	1.19	1.08	1.14	1.28	0.96	1.24	0.94	1.05	1.03
Austria	2004	0.68	1.22	1.11	1.13	1.34	0.94	1.22	0.91	1.03	0.97
Austria	2005	0.68	1.24	1.11	1.15	1.25	1.01	1.18	0.99	1.07	0.97
Austria	2006	0.75	1.21	1.08	1.19	1.26	1.04	1.14	0.99	1.05	1.00
Austria	2007	0.93	1.25	1.06	0.97	1.24	1.03	1.11	0.98	1.01	1.04
Austria	2008	0.82	1.19	1.09	1.01	1.41	1.02	1.04	0.94	1.10	1.02
Austria	2009	1.11	1.10	1.12	0.96	1.21	1.01	1.02	0.92	1.05	1.03
Belgium	2003	0.64	1.06	1.00	1.15	1.05	1.00	1.15	0.94	1.12	1.03
Belgium	2004	0.67	0.89	1.02	1.09	0.99	1.02	1.18	0.87	1.04	1.00
Belgium	2005	0.61	1.01	0.99	1.12	1.07	1.04	1.16	0.86	1.06	1.04
Belgium	2006	0.75	1.09	0.99	1.13	1.07	0.99	1.16	0.90	1.12	1.04
Belgium	2007	0.86	1.09	1.05	1.20	1.29	1.05	1.12	0.95	1.14	1.09
Czech Republic	2004	1.06	1.15	1.02	1.25	1.06	1.09	1.45	1.12	1.24	1.18
Czech Republic	2005	1.04	1.12	1.02	1.21	1.15	1.11	1.26	1.05	1.21	1.17
Czech Republic	2006	1.04	1.08	0.99	1.21	1.05	1.10	1.37	1.06	1.18	1.14
Czech Republic	2007	0.98	1.08	0.97	1.22	0.95	1.05	1.64	1.03	1.14	1.12
Czech Republic	2008	0.95	1.07	1.03	1.21	1.04	1.08	1.50	1.08	1.14	1.14
Czech Republic	2009	0.91	1.03	1.01	1.20	1.04	1.08	1.48	1.10	1.21	1.22
Denmark	2003	0.82	1.04	1.21	0.91	0.84	1.00	1.11	0.93	1.02	1.00
Denmark	2004	0.96	1.08	1.21	0.92	1.02	0.98	1.15	0.94	1.08	0.98
Denmark	2005	0.76	1.06	1.14	0.98	0.85	0.95	1.06	0.94	1.12	0.96
Denmark	2006	0.80	1.09	1.13	0.98	0.83	1.04	1.07	0.96	1.03	0.99
Denmark	2007	0.96	1.09	1.14	1.02	0.88	1.04	1.02	0.93	1.04	0.98
Denmark	2008	0.81	1.05	1.20	0.97	0.69	1.02	1.06	1.00	1.08	1.00
Denmark	2009	0.81	1.05	1.21	0.95	0.80	0.99	1.09	0.96	1.07	0.96
Estonia	2003	0.88	1.09	0.93	1.26	1.27	1.09	1.59	1.35	1.03	0.94
Estonia	2004	1.06	1.01	0.86	1.44	1.31	1.08	1.64	1.72	1.15	1.12
Estonia	2005	0.95	1.04	1.00	1.31	0.72	0.97	1.34	1.47	1.11	1.17
Estonia	2006	0.85	1.03	0.89	1.29	0.84	0.86	1.42	1.83	1.08	1.13
Estonia	2007	0.84	1.06	0.80	1.34	0.89	0.90	1.21	1.76	1.07	1.25
Estonia	2008	1.27	0.99	0.74	1.24	0.85	0.95	1.18	1.65	1.13	1.44
Estonia	2009	1.02	0.99	0.82	1.28	1.20	0.93	1.11	1.52	0.93	1.19
Finland	2004	1.35	1.03	1.28	0.95	1.07	0.98	0.98	1.21	1.09	1.07
France	2003	1.00		1.17	1.19	1.29	1.04	1.29	1.18	1.14	1.07
France	2004	1.07		1.25	1.25	1.30	1.06	1.26	1.12	1.10	1.09
France	2005	0.99		1.21	1.19	1.35	1.09	1.30	1.14	1.15	1.09
France	2006	0.88		1.25	1.33	1.62	1.17	1.45	1.35	1.21	1.15
France	2007	1.02		1.11	1.19	1.36	1.11	1.21	1.17	1.14	1.05
Germany	2004	0.71	0.96	0.88	0.94	0.93	0.80	1.04	0.73	0.93	0.95
Germany	2006	0.94	1.11	0.94	1.13	1.05	0.96	1.00	1.02	1.10	1.05
Germany	2007	0.88	1.09	0.90	1.09	1.22	0.87	0.98	0.97	1.10	1.07
Germany	2008	0.96	1.05	0.99	1.05	1.11	0.94	0.95	0.86	1.01	1.00
Germany	2009		1.03	0.96	1.05	1.05	0.96	0.98	0.86	0.94	1.02
Greece	2009	1.56	1.09	0.73	1.21	1.24	1.04	1.26	1.28	1.12	1.22
Hungary	2004	1.74	1.34	1.19	1.75	1.56	1.64	1.38	2.44	1.19	1.59
Hungary	2006	1.23	1.28	1.29	1.68	1.27	1.41	1.77	2.09	1.17	1.45
Hungary	2007	1.22	1.25	1.18	1.60	1.33	1.40	1.78	2.35	1.06	1.46
Hungary	2008	1.32	1.25	1.17	1.70	1.26	1.40	1.59	2.13	1.04	1.45
Hungary	2009	1.32	1.26	1.08	1.62	1.16	1.36	1.44	2.07	1.00	1.47
Ireland	2006	0.77	1.04	1.45	1.21	1.25	1.22	1.09	1.06	1.30	1.44
Ireland	2007	0.96	0.99	1.48	1.19	1.28	1.29	1.21	0.99	1.32	1.52
Ireland	2008	1.06	1.12	1.50	1.21	1.24	1.31	1.36	1.05	1.37	1.45
Italy	2006	1.18	0.97	0.94	1.04	1.68	1.20	1.12	0.94	0.95	0.90
Italy	2007	1.02	0.98	0.94	1.02	1.43	1.22	1.19	0.96	1.03	0.94

Country	Year	A-B	C-D-E	F	G	H	I	J	K	M	N
Italy	2008	0.96	1.02	0.97	1.02	1.49	1.33	1.14	0.96	0.94	0.94
Italy	2009	1.04	0.98	0.95	1.02	1.58	1.26	1.11	0.91	1.02	0.97
Luxembourg	2003		0.90	0.89	1.08	0.90	0.87	1.05	0.99	1.02	0.91
Luxembourg	2004		0.92	0.90	1.06	0.82	0.88	1.11	0.87	1.03	1.06
Luxembourg	2005		0.95	1.01	1.03	0.83	0.91	1.07	0.85	1.01	1.01
Luxembourg	2006		0.92	0.97	0.97	0.85	0.93	1.02	0.90	1.06	1.01
Luxembourg	2007		0.86	0.99	1.04	0.90	0.90	1.02	0.87	1.06	1.04
Luxembourg	2008		0.84	1.00	1.10	0.99	0.87	1.02	0.81	1.04	0.84
Luxembourg	2009		0.79	0.97	1.11	0.88	0.92	0.99	0.88	1.07	0.98
Netherlands	2004	0.85	0.94	0.97	0.85	0.82	0.94	0.93	0.70	1.01	0.74
Netherlands	2005	1.00	0.96	0.97	0.95	0.84	1.01	0.94	0.73	1.01	0.87
Netherlands	2006	0.95	0.92	1.02	0.93	0.89	0.99	1.00	0.75	1.05	0.90
Netherlands	2007	1.06	0.89	0.93	0.84	0.76	1.05	1.00	0.72	1.12	0.85
Netherlands	2008	0.81	0.88	1.03	0.85	0.66	0.95	0.94	0.75	0.98	0.89
Netherlands	2009	0.91	0.91	0.99	0.83	0.71	0.91	1.05	0.74	0.93	0.88
Poland	2005	1.84	1.14	1.17	1.31	1.37	1.05	1.26	1.52	1.13	0.97
Poland	2006	1.63	1.09	1.09	1.40	1.04	1.01	1.01	1.60	1.14	0.95
Poland	2007	1.42	1.04	0.94	1.19	1.04	0.90	0.91	1.47	1.10	0.99
Poland	2008	1.47	1.02	0.84	1.13	1.26	0.97	0.88	1.25	1.05	1.02
Portugal	2006	0.89		1.07	1.06	1.00	1.15	1.13	0.92	1.06	1.11
Slovakia	2004	1.28	1.69	1.51	1.97	1.51	1.70	2.62	1.75	1.42	1.43
Slovakia	2005	1.41	1.68	1.54	1.90	1.57	1.73	2.31	1.90	1.47	1.56
Slovakia	2006	1.37	1.58	1.38	1.59	1.54	1.46	2.36	1.57	1.27	1.43
Slovakia	2007	1.32	1.45	1.23	1.57	1.18	1.35	2.15	1.29	1.15	1.25
Slovakia	2008	1.21	1.21	1.06	1.29	1.01	1.22	1.73	1.23	1.04	1.22
Slovakia	2009	1.32	1.19	0.94	1.37	1.04	1.14	1.70	1.23	1.07	1.24
Slovenia	2004	1.16	1.10	1.15	1.22	1.49	1.23	1.02	1.34	1.02	1.16
Slovenia	2005	0.94	1.12	1.03	1.23	1.24	1.17	1.05	1.28	0.96	1.09
Slovenia	2006	1.06	1.11	1.05	1.25	1.21	1.21	1.05	1.27	0.96	1.07
Slovenia	2007	1.05	1.11	1.08	1.18	1.13	1.16	1.12	1.25	1.00	1.03
Slovenia	2008	1.18	1.10	1.04	1.19	1.17	1.15	1.12	1.19	1.07	1.08
Slovenia	2009	1.04	1.08	1.05	1.16	1.22	1.11	1.09	1.15	1.07	1.07
Spain	2005	0.75	1.03	1.12	1.04	1.45	1.02	1.47	1.30	1.14	1.28
Spain	2006	0.86	1.04	1.14	1.03	1.33	1.03	1.47	1.21	1.12	1.22
Spain	2007	0.80	1.04	1.10	1.01	1.27	0.98	1.39	1.24	1.15	1.20
United States	1998		1.21	1.11	1.27	0.74	1.15	1.45	1.26	0.94	1.15
United States	1999		1.21	1.11	1.29	0.73	1.12	1.50	1.34	0.94	1.10
United States	2000		1.20	1.12	1.29	0.73	1.14	1.51	1.29	0.97	1.10
United States	2001		1.18	1.09	1.22	0.69	1.12	1.57	1.26	0.96	1.12
United States	2002		1.16	1.08	1.23	0.68	1.09	1.40	1.18	0.97	1.12
United States	2003		1.20	1.06	1.12		1.11	1.42	1.08	0.98	1.08
United States	2004		1.19	1.07	1.08		1.17	1.46	1.13	0.95	1.11
United States	2005		1.23	1.15	1.10		1.16	1.67	1.18	0.94	1.11
United States	2006		1.26	1.16	1.17		1.14	1.57	1.18	0.96	1.11
United States	2007		1.27	1.18	1.11		1.17	1.65	1.20	0.95	1.07
United States	2008		1.24	1.16	1.12		1.18	1.56	1.21	0.98	1.08
United States	2009		1.23	1.10	1.15		1.09	1.50	1.15	0.95	1.15

ISIC 3 industries: (A) Agriculture, hunting and forestry; (B) Fishing; (C) Mining and quarrying; (D) Manufacturing; (E) Electricity, gas and water supply; (F) Construction; (G) Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; (H) Hotels and restaurants; (I) Transport, storage and communications; (J) Financial intermediation; (K) Real estate, renting and business activities; (L) Public administration and defense; compulsory social security; (M) Education; (N) Health and social work; (O) Other community, social and personal service activities; (P) Private households with employed persons; and (Q) Extra-territorial organizations and bodies.

Notes: The results for Public Administration (industry L) are in Appendix B. Results for industries O-Q cannot be determined because data availability is insufficient. Also for certain countries some information is missing (e.g. industry C in France is missing in STAN or industry B in Luxembourg doesn't exist due to the country's landlockedness).

Chapter 4
Do higher government wages reduce corruption? Evidence based on a novel dataset

4.1 Introduction[1]

Corruption is often identified with low government wages (Feinberg, 2009; Klitgaard, 1989; Lindauer, 1987; Stasavage, 1999), but there is no conclusive evidence that raising government wages will reduce corruption (Ni and Van, 2006). On the one hand, it has been argued that higher government wages may deter corruption because corrupt bureaucrats and politicians face higher costs when detected (Becker and Stigler, 1974) or because public servants will forgo corrupt activities when they are paid wages that they perceive as fair (Van Rijckeghem and Weder, 2001). Higher government wages may also attract better employees thereby improving the bureaucratic quality and reducing corruption (UlHaque and Sahay, 1996). On the other hand, it also has been argued that corrupt bureaucrats in highly corrupted environments often use their power and income to influence the probability of corruption detection (Marjit and Shi, 1998) and/or avoid legal punishment if they are detected (Chang and Lai, 2002; Qijun and Kahana, 2010). Under those circumstances, the threat of job loss is low, thereby mitigating the effectiveness of higher wages as a means to deter corruption. In view of the conflicting theoretical arguments, the effect of government wages on corruption has to be settled through empirical research (Van Rijckeghem and Weder, 2001).

However, empirical studies on the relationship between government wages and corruption yield conflicting evidence. Van Rijckeghem and Weder (2001) find that an increase in government wages reduces corruption. Also Herzfeld and Weiss (2003), Pellegrini and Gerlagh (2008) and Dutt (2009) report a negative relationship between government wages and corruption, although the results are often not robust to different econometric specifications.[2] In contrast, the results of Panizza (2001), Ades and Di Tella (1997), and

[1] This chapter is based on Le, V.H., de Haan, J., Dietzenbacher, E., 2013. Do higher government wages reduce corruption? Evidence from a novel dataset. CESifo Working Paper No. 4254.

[2]Several studies using local data for the United States, such as Goel and Nelson (1998), and Goel and Rich (1989), report that higher government wages reduce corruption, measured by the number of corruption convicts. Di Tella and Schargrodsky (2003) find that higher government wages reduce corruption by hospital officials in Buenos Aires, Argentina.

Treisman (2000, 2007) suggest that there is no significant relationship between both variables while La Porta et al. (1999) even find that higher government wages are correlated with more corruption.

All of the above mentioned studies use one of the three available datasets on (relative) government wages, created by Schiavo-Campo et al. (1997), Van Rijckeghem and Weder (1997) and Panizza (2001), respectively. The first one is a cross sectional dataset referring to the early 1990s, while the other two consist of short panels for a small number of developing countries in the late 1980s and 1990s. Schiavo-Campo et al. (1997) and Van Rijckeghem and Weder (1997) follow Heller and Tait (1984), i.e. they use macro data to impute government wages (which are obtained from dividing the total government wage bill by total government employment). In contrast, Panizza (2001) relies on micro data, using some 60 household surveys from 13 Latin American countries in the 1990s to estimate government wages.

We contribute to the literature by analyzing the relationship between government wages and corruption, using a new large panel dataset on government wages of about 1,200 observations, covering 113 countries over the 1989–2010 period. It is derived from micro-based data sources, such as household budget surveys or labor force surveys. Although micro data arguably yield more reliable figures on government wages than macro data (see Chapter 3), they hardly have been used at a large scale due to lack of data. Furthermore, our dataset covers a large number of developing and industrial countries; the data for each country cover a period of 11.8 years on average. The data allow us to control for country-specific effects to avoid the potential endogeneity problem that occurs if corrupt countries deliberately choose to pay low government wages to maintain a corrupt bureaucracy for reasons of cost effectiveness (Besley and McLaren, 1993).

In most of our econometric models we include an interaction term between government wages and the level of income per capita. When the interaction term is not included, we find that the impact of government wages on corruption is rather modest. When the interaction with income is included, the results are quite different. First, the impact of government wages on corruption (which is measured on a scale running from 0 to 6) varies with the level of income per capita. The estimated impact is significantly negative if GDP per capita in international US dollars (in 2012 prices) is lower than 8,842. Second, the impact of government wages on corruption is quite substantial in relatively low-income countries. Increasing government wages by the average wages in manufacturing reduces corruption by more than 1 point (on a scale of 0 to 6) in countries with an income per capita of about 1,000 dollars. This impact is about two times larger than reported by Van Rijckeghem and Weder (2001). Our results are robust to alternative measures of government wages, alternative measures of corruption as well as different econometric specifications.

The chapter will proceed as follows. Section 4.2 reviews recent studies and discusses limitations of previous research that our study aims at improving. Section 4.3 specifies the econometric model and describes the data, while section 4.4 presents the empirical results as well as some robustness checks and extensions. Section 4.5 discusses some policy implications and concludes.

4.2 Literature Review

The most common definition of corruption is "the abuse of public office for private gain" (Rose-Ackerman, 2004). Generally, corruption is regarded as problematic, but some studies suggest that corruption might be the second best solution to the problem of over-regulation (Leff, 1964; Lui, 1985).[3] According to the grease-to-the-wheel view, too much government regulation may end up choking off economic activities. In such an environment, bureaucrats accepting bribes and turning a blind eye to black markets and smuggling may actually improve social welfare. Likewise, bureaucratic corruption reduces the delay caused by red tape and gets the most efficient applicants ahead of a slow queue. However, these arguments are only valid under very specific situations (Bardhan, 2006). The redeeming effects of corruption cannot offset the burden of even more regulations and delays as deliberately imposed by bureaucrats to extract further bribes.

Over the past decades, a large number of studies have examined the nexus between corruption and development. Corruption is found to lower economic growth either directly (Mauro, 1995; Swaleheen, 2011) or indirectly via lowering the incentives for productive investment (Johnson et al., 2011). Corruption engenders unsustainable economic developments (Aidt, 2009) and erodes public confidence in government institutions (Clausen et al., 2011). Corruption can also cause budget consolidation efforts to fail (Arin et al., 2011). Most importantly, corruption sustains further corrupt activities because the public becomes indifferent to the problem (Mauro, 2004) while every new generation of bureaucrats becomes corrupt because their past and current colleagues and seniors are also corrupt (Dong et al., 2012; Sah, 2007). Many developing countries seem to be entrapped in a bad equilibrium of rampant corruption, poverty and stagnation. Consequently, fighting corruption has been on top of the policy agenda of several international development organizations.

4.2.1 Theory

Raising government wages to combat corruption seems an intuitive solution because it lessens the bureaucrats' incentive to extract illegal income. Several studies therefore suggest paying higher government wages to break the vicious circle of corruption and poverty (Bond, 2008; Bose, 2004; UlHaque and Sahay, 1996; Van Rijckeghem and Weder, 2001).

First, higher government wages deter corruption via two mechanisms: raising the cost of corruption and increasing the probability of detection (Becker and Stigler, 1974; Van Rijckeghem and Weder, 2001). When the probability that corruption is detected is high and the threat to lose a well-paid job is real, bureaucrats will avoid corruption because it is no longer an optimal choice when maximizing income.

Second, high government wages boost the dignity of civil servants and encourage them to forgo corrupt activities, even when corruption is the optimal choice to maximize income (Van Rijckeghem and Weder, 2001). Arguably, people choose to work for the government because they want to serve society (Macchiavello, 2008). These civil servants might be

[3] Meon and Weill (2010) claim that corruption improves efficiency in countries with a weak institutional system. However, these authors do not control for country-specific effects.

forced to engage in corruption to ensure sufficient income but each act of corruption is associated with some moral cost (Bond, 2008; UlHaque and Sahay, 1996). As a result, a proportion of the bureaucracy may forgo corruption opportunities as long as they are paid at a level perceived to be fair, even if the probability of corruption detection and punishment is low (Van Rijckeghem and Weder, 2001).

Third, a government pay rise may serve as an exogenous shock to a high-corruption equilibrium. High government wages attract better people to the bureaucracy and prevent the movement of qualified employees to the private sector (UlHaque and Sahay, 1996). The public also becomes more vigilant to the operation of the bureaucracy when government wages are high (Van Rijckeghem and Weder, 2001), putting more pressure on bureaucrats to forgo corruption themselves and to report corruption by others. Hence, even a modest raise in government wages can lead to a new equilibrium with less corruption.

In contrast, other studies argue that high government wages do not reduce corruption or may even lead to more corruption (Besley and McLaren, 1993; Chang and Lai, 2002; Macchiavello, 2008). In a highly corrupted environment where the probability of detection as well as the probability of getting punishment upon detection is very low, the threat of job loss is close to zero. In such a situation, higher government wages will not change the incentive structure faced by bureaucrats (Van Rijckeghem and Weder, 2001). Selfish agents will also queue up for government jobs because of the high income from wages plus the illegal income from corruption, and government remuneration policy may end up unintentionally attracting too many individuals with the wrong 'talent' to the bureaucracy (Aidt, 2003; Bond, 2008; Macchiavello, 2008). Highly paid but selfish bureaucrats may also use part of their wage package to bribe their seniors when they are detected (Chang and Lai, 2002). More severely, highly paid government jobs become a scarce good that can be rationed only to those who can mobilize sufficient finances to buy such jobs via bribing the recruiting officials. In return, new bureaucrats will try to corrupt even more to recover their initial investment (Qijun and Kahana, 2010).

4.2.2 Empirical evidence

In view of the conflicting theoretical arguments, empirical research may shed some light on the effect of government wages on corruption. The most commonly used empirical model to estimate the impact of government wages on corruption across countries is the following linear regression model:

$$\boldsymbol{CORR_{it} = X_{it}\beta + WAGE_{it}\gamma + \alpha_i + \varepsilon_{it}} \qquad (\mathbf{4.1})$$

where $CORR$ is a measure of corruption, X is a set of control variables, $WAGE$ is some measure for government wages, $[\beta, \gamma]$ is the corresponding vector of coefficients and α is the country- specific effect. The subscript i denotes countries, t indicates time and ε is the error term. To make cross-country figures comparable, $WAGE$ usually is an indicator (Ades and Di Tella, 1997; Heller and Tait, 1984; Schiavo-Campo et al., 1997; Van Rijckeghem and Weder, 2001). Often it is constructed as the ratio of government wages and wages in another reference sector (such as manufacturing) or as the ratio of government wages and GDP per capita.

Several problems emerge from reviewing these studies. First and foremost, they are based on unreliable data. Generally, average government wages are imputed by dividing the total government wage bill by total government employment. However, there is no internationally accepted statistical method to make government employment statistics consistent across countries. Similar difficulties arise with respect to consistency over time, due to the presence of different types of government workers (such as permanent vs. temporary, full time vs. part time). In Chapter 3 it has been shown that this leads to a substantial bias that may render empirical conclusions unreliable. Only Panizza (2001) uses micro data to construct an indicator of government wages. However, this study is limited to a small number of countries and covers a short time period with about 60 observations in total.

Second, most studies treat the term α_i in Equation (4.1) as independent of $WAGE$ and other explanatory variables in X_i. However, models estimated in cross-country studies are often shaped by data availability. Therefore, α_i is possibly not independent of X_i. Panel studies, such as Panizza (2001) and Van Rijckeghem and Weder (2001), use pooled OLS or random effects estimators, which again rely on the same assumption that α_i is independent from all the explanatory variables. The results in Seldadyo and de Haan (2011), however, suggest that country-specific factors may play an important role in a country's ability to control corruption.[4]

4.3 The econometric model specification and data description

4.3.1 The econometric model

We specify our empirical model as:

$$\boldsymbol{CORR}_{it} = \boldsymbol{\beta X_{it}} + \boldsymbol{\gamma WAGE_{it}} + \boldsymbol{\lambda INCOME_{it}} + \boldsymbol{\delta(WAGE_{it} \times INCOMEit)} + \boldsymbol{\alpha_i} + \boldsymbol{\eta T} + \boldsymbol{\varepsilon_{it}} \quad (\mathbf{4.2})$$

where $INCOME_{it}$ is the income level of country i at time t, and T is a vector of year dummies to control for the time specific effects. The other variables are defined as before.

The sign of γ is expected to be negative. In our view, the impact of government wages on corruption is conditional upon the level of income in each country, but the sign of δ is not clear a priori. In low-income countries, corruption is rampant and the amount of money involved in each bribe can be very small (petty corruption). Higher government wages will stimulate bureaucrats to forgo this petty corruption. Furthermore, highly paid government jobs in low-income countries are highly valued. This means that the threat of job loss is arguably more effective in low-income countries. Under this reasoning, government wages may have a strong negative impact on corruption in low-income countries. This impact is weaker or even close to zero in rich countries. If true, the sign of δ will be positive.

[4] These authors find convergence of corruption: many corrupt countries became 'cleaner' between 1984 and 2008, while many 'clean' countries became more corrupted. However, the speed of change is relatively slow, suggesting that country-specific factors play an important role in the ability of a country to control corruption.

However, richer countries often have a better legal system with higher probability of corruption detection. Furthermore, the fair wage argument might not apply to low-income countries because bureaucrats know that their governments may not be able to meet the demand of fair wages due to budget constraints (Van Rijckeghem and Weder, 2001). This line of argument, instead, suggests that government wages only reduce corruption in relatively rich countries. In low-income countries, raising government wages may have no impact. The sign of δ, in this case, will be negative.

On the basis of previous studies, we select a large number of control variables (X_{it} in Equation (4.2)) that have been suggested to affect corruption. The selected variables can be grouped into political factors, economic factors, incentive structure factors, and other factors.

Political factors are important to ensure a healthy institutional environment of sufficient checks and balances as well as effective mechanisms for the public to monitor the operation of the bureaucracy. The most important political variables are democracy (DEM), the age of the democracy ($DEMAGE$) and political polarization ($POLAR$) (Brown et al., 2011; Rock, 2009). DEM (the Polity2 indicator) runs from -10 to 10, where a higher value means more democracy. $DEMAGE$ is measured as the number of consecutive years since the year the country is classified as a democracy.[5] We also include $DEMAGESQ$, the squared term of $DEMAGE$, as democracy may need time to take effect on corruption (Rock, 2009). $POLAR$ is a dummy variable that is equal to 1 if the difference in terms of political orientation of the parties in government is classified as high by Beck et al. (2001, updated 2010). Brown et al. (2011) find that high polarization intensifies the monitoring process, thus reducing corruption. Finally, we include a dummy variable (MIL), which equals 1 if the head of the country is a military officer (Beck et al., 2001, updated 2010). When a country is governed by the military, the military become exposed to politics and may be captured by interest groups, which could increase the amount of corruption in the system (Brown et al., 2011).

The most often used *economic determinants*[6] of corruption are government consumption ($GOVSIZE$) and openness to trade ($TRADE$), both taken from the World Bank. A larger government implies more possibilities for corruption by the bureaucracy. Trade exposes corrupted countries to international competition and interaction, which reduce the monopoly power of domestic producers, shrinking the potential profits available for corrupt officials.

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[5] Following Treisman (2007), we classify a country as democratic if its executive electoral competitiveness index provided by Beck et al. (2001) is 6.5 or higher.

[6] Some recent studies, such as Arezki and Bruckner (2011) and Bhattacharyya and Hodler (2010), find that oil rents induce corruption when the democratic institutions are weak or when state participation in oil production is high. We follow Treisman (2007) and include a variable on raw material exports (measured as the percentage of commodity exports) to control for the impact of natural resource 'windfalls'. However, this variable is not significant and makes our sample smaller, although it does not affect our findings. In the reported results, we therefore leave this variable out. Results are available on request.

Finally, we include a large number of other time invariant variables that are often mentioned in the literature as potential determinants of corruption. Treisman (2000) finds that countries that have a Common Law legal origin and a UK colonial history are less corrupted. He also finds that ethno linguistic division is related to more corruption. We include three dummies accounting for English Common Law, French, and Socialist legal origins (source: Quality of Government Institute, Gothenburg University). There are also dummies for countries with a British, French and Spanish colonial origin (source: Quality of Government Institute, Gothenburg University) and a measure for linguistic fractionalization provided by Alesina et al. (2003). Finally, we add 8 dummies for geographical regions (Eastern Europe and post Soviet Union; Latin America; North Africa and the Middle East; Sub-Saharan Africa; Western Europe and North Africa; East Asia; Southeast Asia; and the Caribbean). Countries in the same region may follow similar wage and anti-corruption policies.

4.3.2 Sources of data

We use the International Country Risk Guide (ICRG) corruption index as the dependent variable. Previous studies frequently used the corruption perception index (CPI) provided by Transparency International and the control of corruption index provided by the World Bank World Governance Indicator (WGI) as measures of corruption.[7] The CPI and the WGI aggregate several surveys to form a corruption perception index using the simple average and principal component analysis, respectively. However, the included underlying surveys may differ from one year to the other. As a result, changes in the CPI and WGI scores may be due to the changes in surveys included instead of the changes in perceived corruption (Teorell et al., 2011). The ICRG index has been constructed in a consistent way from year to year. The experts who provide input for constructing the index receive instructions on how to carry out the ratings, making the data comparable across countries. Furthermore, using country experts' ratings may better reflect the actual situation in the rated countries. That is because the experts' ratings are less likely to be affected by the economic situation than ratings based on public opinion sources (Kaplan and Pathania, 2010) and because the experts' ratings are less likely to be affected by the fear of retaliation by corrupted government officials (Jensen et al., 2010). We rescale the original ICRG index to a scale ranging from 0 to 6 where a higher score means more corruption.

Data on government wages are taken from the worldwide database on industrial wages as reported in Chapter 2. This database provides data on average wages for the whole economy as well as for industries according to the International Standard Classification of Economic Activities, Revision 3 (ISIC 3). One part of the data is obtained via international household survey databases, such as the World Bank Living Standard Measurement Study, the Luxembourg Income Study or data from the International Labor Organization. The other part of the data is obtained by studying countries' data archives. Next to the fact that survey data are more accurate than macro data obtained from statistical yearbooks (see

[7] The correlation of these three indices between countries is very high, see Seldadyo (2008). However, when it comes to the within country variation of corruption over time, the correlation between the indices is low. Over the 1996-2010 period, the correlation coefficients between these three indices (after mean-centering) are between 0.10 and 0.37, which indicates that they are anything but close.

Chapter 3), they also open a new path to overcome the problem of missing data for developing countries, where reliable macro data on government wages and on employment are often lacking.

Individuals with positive employment income are first classified into ISIC 3 one digit industries. Next, the average wages in each industry are estimated as the mean wages of all individuals within that industry, using relevant weights to account for missing values and non-response. The resulting wages computed in this manner have been found to be the unbiased estimates of actual wages (Akee, 2011; Kapteyn and Ypma, 2007). We define government wages as the wages of employees in the public administration, defense and compulsory social security industry (public administration from now on). Public administration is the core sector of the government which is responsible for carrying out most government programs as well as implementing laws and regulations. Furthermore, to compute our government wage indicator ($WAGE$) we follow previous studies and divide average government wages by average wages in manufacturing. In the sensitivity analysis, we use average wages in the finance sector and average wages in construction as alternative denominators to construct the $WAGE$ indicator.

Table 4.1. Summary of the main variables

Variable	N	Mean	Min	Max	Definition and sources
CORR	930	2.69	0	6	ICRG corruption, available for purchase at http://www.prsgroup.com/icrg.aspx
WAGE	1076	1.3	0.38	3.07	The ratio of government to manufacturing wages, available at http://www.levanhab28.com/
INCOME	1076	9.4	6.67	11.37	The natural logarithm of GDP per capita (in 2012 international dollars), available from the World Bank's World Development Indicators (WDI) database
WINCOME	1076	12.21	2.89	26.83	The product of WAGE and INCOME
DEM	1014	7.11	-10	10	The revised Polity2 score available at http://www.systemicpeace.org
POLAR	1038	2.56	0	8	A dummy which equals 1 if a country is classified as highly polarized by Beck et al. (2001), as updated in 2010 and available at www.worldbank.org
DEMAGE	1038	13.09	0	64	Age of the democracy, the number of consecutive years since the year the country is classified a democracy from 1930 until now. Following Treisman (2007), we classify a country as democratic if the executive electoral competitiveness index produced by Beck et al. (2001) is larger than or equal to 6.5. The variable is rescaled to 10 years to prevent the magnitude of the corresponding estimated coefficients from becoming too small.
DEMAGESQ	1040	0.32	0	1	The square of DEMAGE
MIL	1028	0.02	0	1	A dummy which equals 1 if the chief executive is at the same time an army officer; source: Beck et al. (2001)
GOVSIZE	1076	0.17	0.03	0.54	Total final general government consumption as a percentage of GDP, provided by the WDI. This variable is further divided by 100 to prevent the magnitude of the corresponding estimated coefficient from becoming too small.
TRADE	1076	0.87	0.14	3.2	Total import and export as a percentage of GDP, provided by the WDI. This variable is further divided by 100 to prevent the magnitude of the corresponding estimated coefficient from becoming too small.
GOVSTAB	930	8.32	3.33	12	ICRG government stability score
BURQUAL	930	2.69	0	4	ICRG bureaucratic quality score

Our $WAGE$ indicator features several improvements in comparison with the data used in previous studies. Most importantly, it is computed from micro surveys and is therefore more reliable than government wages computed from macro data sources. Moreover, the data on both the numerator and the denominator of the $WAGE$ indicator are from the same survey in which the wage concept is consistently used. As a result, our $WAGE$ indicator is likely to better capture the relative wage position of government employees.

Most of our control variables are taken from standard sources such as the World Bank's World Development Indicators (WDI); the World Bank's Political Institutions Database (Beck et al., 2001); and the Polity IV Project. In case the WDI does not provide data, the data for these countries are taken from the Penn World Table. Some other variables are taken from the Quality of Government dataset, collected from various sources by the Quality of Government Institute at the University of Gothenburg. Table 4.1 presents summary information of the main variables, while Appendix 4.A provides more detailed information for all variables. We only retain country/years if we have data for both corruption and government wages.

Table 4.2. The correlation matrix

	CORR	WAGE	INCOME	WINCOME	DEM	DEMAGE	DEMAGESQ	POLAR	MIL	GOVSIZE	TRADE	GOVSTAB
CORR	1											
WAGE	0.35	1										
INCOME	-0.63	-0.19	1									
WINCOME	0.17	0.94	0.15	1								
DEM	-0.38	0.13	0.54	0.30	1							
DEMAGE	-0.64	-0.24	0.71	-0.03	0.44	1						
DEMAGESQ	-0.65	-0.31	0.68	-0.11	0.36	0.97	1					
POLAR	-0.36	-0.03	0.32	0.06	0.31	0.34	0.31	1				
MIL	0.17	0.03	-0.12	-0.02	-0.23	-0.06	-0.08	-0.11	1			
GOVSIZE	-0.46	-0.20	0.36	-0.08	0.18	0.31	0.34	0.18	-0.11	1		
TRADE	0.07	-0.04	0.07	-0.01	0.04	-0.05	-0.01	-0.11	-0.12	0.19	1	
GOVSTAB	-0.02	-0.08	0.06	-0.05	-0.21	0.01	0.04	-0.02	-0.01	0.00	0.12	1
BURQUAL	-0.74	-0.32	0.77	-0.09	0.47	0.71	0.71	0.33	-0.21	0.52	0.08	0.05

Table 4.2 presents the correlation of variables included in Table 4.1. $WAGE$ is positively correlated with $CORR$, and the coefficient is 0.35, suggesting that the gap between government wages and manufacturing wages is larger in more corrupted countries. The correlation between $WINCOME$ and corruption is 0.17 while the correlation between $INCOME$ and corruption is -0.63, reflecting that high-income countries are less corrupted. The correlation between $WAGE$ and the other explanatory variables is quite low and the same holds for $WINCOME$. Note that the correlation between $WAGE$ and $WINCOME$ is very high (0.94) and, not surprisingly, this applies also to $DEMAGE$ and $DEMAGESQ$.

4.4 Results

Although the original dataset contains about 1,200 observations for government wages, missing data for other variables reduces the sample to a minimum of 898 observations over 76 countries. Appendix 4.B presents the list of countries included in the analysis. We first run the full model using the random effects estimator and test for the validity of the random effects model using the Sargan overidentifying restriction test. The random effects model is rejected at conventional levels of statistical significance. We therefore resort to the fixed effects estimator for inferences, although this choice will lead to a loss of information because the impact of time invariant factors cannot be estimated.

4.4.1 Base line results

Table 4.3 presents our estimation results. Besides 20 time dummies which are always included, the number of explanatory variables varies from the most parsimonious model in

column (2) to the most general model in column (6). In column (2), only $WAGE$ and $INCOME$ are included. We stepwise add $WINCOME$ in column (3), political factors in column (4), economic factors in column (5), and the incentive structure variables in column (6). This step-by-step inclusion of different sets of control variables shows the effects of our most important explanatory variables, $WAGE$ and $INCOME$, on corruption as well as the changes in these effects when other determinants of corruption are included. The results confirm that the impact of government wages on corruption is significant and varies with the level of income.

Table 4.3. The main results

Explanatory Variables	Wages and GDP Only	Interaction	Political factors	Political and economic factors	Full model
(1)	(2)	(3)	(4)	(5)	(6)
WAGE	-0.30**	-4.14***	-3.83***	-3.90***	-3.36**
	(0.14)	(1.51)	(1.41)	(1.38)	(1.27)
INCOME	1.06***	0.63*	0.63**	0.64**	0.87***
	(0.31)	(0.32)	(0.31)	(0.31)	(0.31)
WINCOME		0.43**	0.39**	0.40**	0.34**
		(0.17)	(0.16)	(0.16)	(0.15)
DEM			-0.05**	-0.06**	-0.05**
			(0.02)	(0.02)	(0.02)
DEMAGE			0.03	0.04	0.12
			(0.15)	(0.16)	(0.15)
DEMAGESQ			-0.02*	-0.02	-0.03**
			(0.01)	(0.01)	(0.01)
POLAR			0.08	0.08	0.08
			(0.07)	(0.07)	(0.07)
MIL			0.70***	0.74***	0.55**
			(0.22)	(0.23)	(0.22)
GOVSIZE				0.63	-0.07
				(2.16)	(1.89)
TRADE				0.36	0.32
				(0.36)	(0.27)
GOVSTAB					-0.10***
					(0.02)
BURQAL					-0.42***
					(0.10)
CONSTANT	-6.84**	-3.05	-2.42	-2.91	-3.29
	(3.03)	(3.03)	(3.13)	(3.33)	(3.25)
Observations	898	898	898	898	898
R-squared	0.38	0.39	0.42	0.42	0.48
No. of countries	76	76	76	76	76

Notes: This table shows estimation results for equation (2). In column (2) only WAGE and INCOME are included as explanatory variables. In column (3) the interaction of WAGE and INCOME is added. In columns (4)-(6) political, economic and incentive structure variables are subsequently added. Robust standard errors corrected for heteroskedasticity and autocorrelation are in parentheses. *, ** and *** indicate significance level of 10, 5 and 1%, respectively. All models control for time and country specific effects.

Without the interaction term and any explanatory variables other than the time dummies and $INCOME$, we see that $WAGE$ has a negative and significant coefficient of -0.30 (column (2) of Table 4.3). When all additional explanatory variables are included, the coefficient of $WAGE$ is still significant and the magnitude of the impact of government wages on corruption becomes slightly larger, equal to -0.35, and is significant at the 1% level when all explanatory variables except $WINCOME$ (the interaction term of $WAGE$ and $INCOME$) are added (not shown). This result is similar to the findings of Van Rijckeghem and Weder (2001) who show that in developing countries—where corruption detection and prosecution rates are low—government wages must be as high as 19 times the average

wages in the manufacturing sector to eliminate corruption. However, the inference based on the model without an interaction term is potentially misleading because the impact of government wages is conditioned by the level of income.

When the interaction term is included in the full model (column (6) of Table 4.3), the coefficient of $WAGE$ becomes more significant and about 10 times larger in magnitude. The coefficient of the interaction term is 0.34 and significant at the 5% level. Its positive sign implies that the negative impact of government wages on corruption reduces as income per capita increases.

It should be stressed that inferences cannot be based on the significance of the interaction or the constitutive terms only (Brambor et al., 2006). Using Equation (4.2), the marginal impact of government wages on corruption is:

$$\frac{\partial CORR}{\partial WAGE} = \gamma + \delta \times INCOME$$

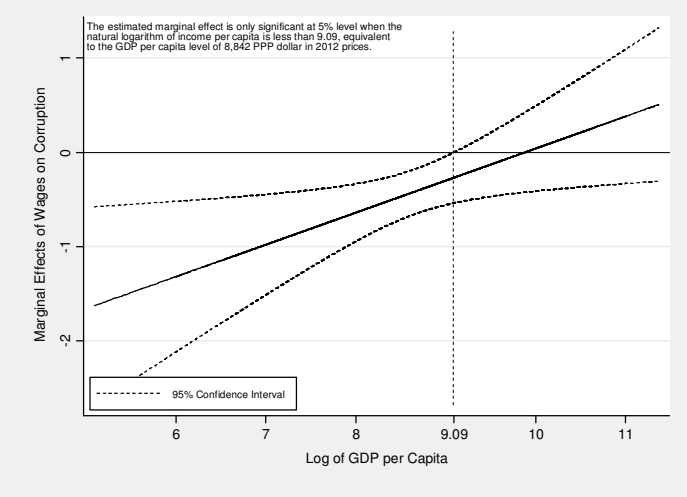

Figure 4.1. The marginal impact of government wages on corruption

For ease of exposition, we graph this marginal effect in Figure 4.1 with the estimated marginal impact of government wages on corruption on the vertical axis and the natural logarithm of GDP per capita on the horizontal axis. The upward sloping solid line shows the marginal impact of government wages on corruption according to column (6) in Table 4.3. The dashed curves show the 95% confidence interval of this estimated marginal impact. The dashed vertical line at 9.09 is the level of income (in logs) below which the estimated impact of government wages on corruption is negative and significant at the 5% level. This corresponds to an income per capita level of $ 8,842, equivalent to income in

countries such as Albania or Ecuador.[8] 299 observations from 40 countries fall into this region. Above this income level of $ 8,842, no significant results can be established. When the income level is higher than $ 19,468, the estimated impact becomes positive although insignificantly different from zero.

We find that within country economic growth leads to more corruption. Based on the econometric specification in Equation (4.2), the marginal impact is the derivative of $CORR$ with respect to $INCOME$, which is $\lambda + \delta \times WAGE$. Because $WAGE$ ranges between 0.38 and 3.1, and λ and δ are both positive, the marginal impact of $INCOME$ on corruption is always positive. We compute the 95% confidence interval of this total impact and find that, regardless of the value of $WAGE$, the 95% confidence interval of $\lambda + \delta \times WAGE$ always is above zero (results are available on request).

Most control variables have the expected sign. The coefficient of DEM is negative and significant in all specifications. A one-point improvement in the Polity2 score leads to a decrease of about 0.05 point in corruption. The age of democracy has an inverted U shape impact on corruption. This inference is based on the fact that the coefficients of $DEMAGE$ and $DEMAGESQ$ are positive and negative, respectively. This finding is consistent with a recent study by Rock (2009) who argues that in the early years of a democracy, corruption may even thrive due to institutional weakness. As the democratization process takes effect, democratic countries will be able to better control corruption. However, Rock (2009) reports that democracies need about 12 years to grow effective institutions to control corruption. Our results indicate that democracies need even longer, up to 22.4 years, to control corruption.[9]

We find that countries whose chief executive leader is a military officer are more corrupted. However, high polarization does not appear to be an important determinant of corruption in these models. As expected, $GOVSTAB$ and $BURQAL$ have a significant and negative impact on corruption.

The coefficients of our proxies for size of government and openness are not significant.

4.4.2 Robustness checks and extensions

Our regression models with corruption on the left hand side and the natural logarithm of GDP per capita on the right hand side may suffer from an endogeneity problem. This is because corruption may affect GDP per capita (as argued by Treisman (2007)), which would imply that reverse causality is present. The ideal solution is to obtain a good instrument for GDP per capita which is not correlated with the error term in Equation (4.2) and apply instrumental variable methods. However, such an instrument is difficult, if not impossible, to obtain.

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[8] If we accept the 10% significance level, the impact of government wages on corruption is negative and significant at the income level of $ 9,721 or lower, equivalent to the income level of countries, such as Tunisia or Thailand.

[9] This result comes from solving the equation $\frac{\partial CORR}{\partial DEMAGE}$=0.1175729-2*0.0262733*DEMAGE = 0. This implies DEMAGE = 2.2374978, equivalent to a period of 22.4 years (this is because DEMAGE is measured in 10 years).

We resort to a somewhat ad hoc solution by taking $INCOME$ with a lag of three years as a proxy for itself.[10] The interaction term $WINCOME$ is now the product of current $WAGE$ with the three-year lagged $INCOME$. We run the model again and present the results in column (2) of Table 4.4. The coefficients of $WAGE$ and $WINCOME$ are almost the same and remain significant at the 1% and 5% levels, respectively. The coefficient of INCOME is smaller, equal to 0.36 as compared to 0.87 in column (6) of Table 4.3, but the marginal impact of $INCOME$ on corruption is still positive and significant at the 5% level. These results suggest that our findings on the impact of government wages on corruption are not affected by the potential endogeneity of $INCOME$.

Another important issue that can render our findings unstable is that $WAGE$ and $WINCOME$ are highly correlated. As we can see in Table 4.2, the correlation coefficient is as high as 0.94. Multicollinearity, as noted by Treisman (2007), can lead to imprecise estimates of the coefficients of interest. To check whether our conclusion is affected by this high correlation, we follow Treisman (2000) and use the absolute value of the geographical latitude of the capital city of the countries in our sample (LAT) as a proxy for their income level and replace $WINCOME$ by $WAGELAT$, i.e. the product of $WAGE$ and LAT.[11] The correlation between LAT and $INCOME$ is 0.55 while the correlation between $WAGELAT$ and $WAGE$ is only -0.04.

The results are shown in column (3) of Table 4.4. While the coefficient of LAT cannot be estimated because it is time invariant, the coefficients of $WAGE$ and $WAGELAT$ still have the same expected sign and are even more significant although their magnitude is smaller, equal to -0.94 and 0.03, respectively. This reduction in the magnitude of the coefficients is because the scale of LAT, which runs from 0 to 65, is different from the scale of $INCOME$, which is between 6.67 and 11.37. It is important to note that while LAT can partly account for the income differences between countries whose capital cities are located at different latitudes, it fails to distinguish between income levels of countries with roughly equal distance from the equator. Even so, the estimates support our finding that the impact of government wages on corruption is moderated by the level of income.

The third issue is the possible reverse causality between corruption and government wages. Perhaps governments can afford to raise wages because corruption is reduced and tax revenues increase as a consequence. We check this possibility by taking the first lag of $WAGE$ while $WAGELAT$ is replaced by the product of this first lag with LAT,[12] $WAGELAT\_1$. The results in column (4) of Table 4.4 show that the coefficients of the

[10] The rationale for taking a lag of three years is twofold. It is necessary to take a sufficiently short lag of INCOME to make a good proxy. At the same time, the lag should be long enough to avoid the "feedback problem".

[11] Using the log of the mortality rate faced by European settlers at the time of colonization by Acemoglu et al. (2001) in place of LAT as a proxy for income, we reach the same conclusion and the results are also significant at the 5% level for former colonies with a high rate of settler mortality. However, the number of observations is significantly reduced to 364 because countries that have never been colonized are omitted. The results are available on request.

[12] Using LAT in place of INCOME, we get rid of the potential endogeneity problem of INCOME and focus on the causality between WAGE and CORR.

variables of interest are somewhat smaller but they still have the expected sign and are significant at the 1% level. Also when we lag $WAGE$ by two and three years, our conclusions remain the same (results are available on request). These findings suggest that the causality runs from government wages to corruption and not the other way around.

Table 4.4. Robustness checks: endogeneity and alternative corruption index

Explanatory Variables	Three-year lagged INCOME	Latitude as a proxy for Income	One-year lagged WAGE	Alternative measure of corruption
(1)	(2)	(3)	(4)	(5)
WAGE	-3.36***	-0.94***	-0.79***	-4.11*
	(1.22)	(0.20)	(0.22)	(2.20)
INCOME	0.36			-0.44
	(0.33)			(0.45)
WINCOME	0.35**			0.39*
	(0.14)			(0.24)
WAGELAT		0.03***		
		(0.01)		
WAGELAT_1			0.02**	
			(0.01)	
DEM	-0.05**	-0.05***	-0.07***	-0.01
	(0.03)	(0.02)	(0.02)	(0.04)
DEMAGE	0.10	0.00	0.04	-0.74***
	(0.14)	(0.17)	(0.14)	(0.24)
DEMAGESQ	-0.04***	-0.04***	-0.04***	-0.09
	(0.01)	(0.01)	(0.01)	(0.07)
POLAR	0.08	0.07	0.04	-0.02
	(0.07)	(0.08)	(0.08)	(0.07)
MIL	0.25	0.45**	0.36**	1.00*
	(0.22)	(0.21)	(0.16)	(0.60)
GOVSIZE	-0.01	-0.02	-0.03**	0.06***
	(0.02)	(0.02)	(0.01)	(0.02)
TRADE	0.00	0.00	-0.00	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
GOVSTAB	-0.09***	-0.07***	-0.09***	0.00
	(0.02)	(0.02)	(0.02)	(0.02)
BURQAL	-0.43***	-0.41***	-0.32***	0.03
	(0.11)	(0.10)	(0.10)	(0.08)
CONSTANT	(3.34)	(0.82)	(0.73)	
	2.16	5.70***	6.29***	
Observations	884	898	882	38,335
Within R-sq	0.46	0.46	0.44	0.09
Number of countries	76	76	74	44

Notes: Columns 2-4 of this table show the estimation results for Equation (4.2), corresponding with column (6) of Table 4.3. In column (2) the three year lagged level of income is used as a proxy for INCOME while in column (3) latitude is used as a proxy. In column (4) the one-year lag of WAGE is used as a proxy for itself. Column 5 presents the results from an alternative measure of corruption using firm level data, the detailed of this model are presented in Appendix C. Robust standard errors corrected for heteroskedasticity and autocorrelation are in parentheses. *, ** and *** indicate significance level of 10, 5 and 1% respectively. All models control for country and time fixed effects.

Our results, thus far, are based on the ICRG corruption index which is consistently ranked across countries and time. However, some studies have raised concerns that experts' ratings may suffer from prior perception, and therefore, can be biased (Treisman, 2007). Furthermore, bureaucrats may target certain areas of the economy to extract rents (Svensson, 2003). For these reasons, we extend our analysis to a different measure of

corruption by using a large sample of firms from the World Bank Enterprise Survey database which consists of about 130,000 firms from 135 countries over the 2002-2011 period. Most of the surveyed countries are developing or former socialist countries. The survey has been repeated several times for each country.

Top managers from the surveyed firms are asked to give their perception on corruption by rating if it is *no obstacle, a minor obstacle, a moderate obstacle, a major obstacle or a very severe obstacle* to the operation of their firm. The top managers' response to this question, running from 0 to 4, is comparable with the (adjusted) ICRG corruption index, with higher values indicating more corruption. However, the major drawback of these firm data for our purpose is that the surveys happen between relatively short intervals during which there might not be any changes in government wages, making the estimation results less stable.

Table 4.5. Robustness checks: alternative government wage indicators and sample split

Explanatory Variables	Comparing industry: Finance	Comparing industry: Construction	OECD	Non-OECD
(1)	(2)	(3)	(4)	(5)
WAGE	-7.48***	-2.14*	-21.63	-2.64**
	(2.53)	(1.17)	(15.52)	(1.17)
INCOME	0.61*	1.02***	0.47	0.71*
	(0.31)	(0.32)	(1.98)	(0.41)
WINCOME	0.80***	0.23*	2.17	0.27*
	(0.28)	(0.13)	(1.52)	(0.14)
DEM	-0.04*	-0.05**	-0.13	-0.05**
	(0.02)	(0.02)	(0.09)	(0.02)
DEMAGE	0.24	0.11	-0.59	-0.05
	(0.18)	(0.17)	(0.58)	(0.30)
DEMAGESQ	-0.02**	-0.02*	-0.03	0.01
	(0.01)	(0.01)	(0.02)	(0.12)
POLAR	0.08	0.08	0.04	0.17*
	(0.07)	(0.07)	(0.08)	(0.10)
MIL	0.56**	0.57**	2.58***	0.36
	(0.22)	(0.22)	(0.57)	(0.26)
GOVSIZE	-0.00	-0.01	0.02	-0.00
	(0.02)	(0.02)	(0.04)	(0.02)
TRADE	0.00	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.01)	(0.00)
GOVSTAB	-0.10***	-0.10***	-0.13***	-0.06*
	(0.02)	(0.02)	(0.03)	(0.03)
BURQAL	-0.41***	-0.40***	-0.37*	-0.39***
	(0.10)	(0.10)	(0.21)	(0.12)
CONSTANT	-1.49	-4.88	3.31	-0.83
	(3.30)	(3.45)	(22.25)	(3.71)
Observations	895	907	410	488
Within R-sq	0.48	0.47	0.57	0.45
Number of countries	78	78	29	47

Notes: This table shows the estimation results for Equation (4.2), corresponding with column (6) of Table 4.3. In columns (2) and (3) government wages are calculated vis-à-vis wages in finance and construction, respectively. In the final columns the sample is split into OECD and non-OECD countries. Robust standard errors corrected for heteroskedasticity and autocorrelation are in parentheses. *, ** and *** indicate significance level of 10, 5 and 1% respectively. All models control for country and time fixed effects.

Given the micro nature of this alternative measure of corruption, we control for both country and firm-specific characteristics. While country-specific variables are the same variables used in Equation (4.2), the firm-specific characteristics aim at controlling for differences between firms in terms of size, ownership, age, legal status and location. We

only keep countries with available data on government wages in the year of the surveys. The final sample consists of 38,335 firms from 44 countries.

Using an Ordered Probit model, we reach the same conclusion as in our previous estimates. The summary results of this model are presented in column (5) of Table 4.4, while the full model specification and the detailed estimation results are presented in Appendix 4.C. We also compute the marginal impact of government wages on this alternative measure of corruption and find similar results as in Figure 4.1. However, the firm level data suggest that the marginal impact is significant until a GDP per capita level of 10,534 dollars, which is higher than the threshold of 8,842 dollars which we found using macro data.

Our findings are also robust to alternative ways of constructing the WAGE indicator. Instead of the wages in manufacturing, we use the wages in the financial sector and the wages in construction as alternative denominators of the WAGE indicator. The results are reported in columns (2) and (3) of Table 4.5, respectively. For the first alternative, the coefficients of WAGE and WINCOME are much larger than the corresponding estimates in column (6) of Table 4.3. For the second alternative, however, these coefficients become smaller. Examining the data, we find that wages in construction are generally lower than wages in manufacturing so that the values for WAGE are larger when construction is taken as the comparing industry. In the same fashion, the values for WAGE are smaller when the financial sector is taken as the comparing benchmark because wages in finance are generally higher than wages in manufacturing. The changes in the coefficients of WAGE and WINCOME in columns (2) and (3) of Table 4.5 when compared to those in Table 4.3 reflect these relative wage differentials. Similar results are also obtained when we use the wages in other sectors, such as wholesale and retail, transportation or the whole economy as the benchmark to compare

Finally, we split the sample into OECD and non-OECD countries. The results are presented in columns (4) and (5) of Table 3.5, respectively. The coefficients of WAGE and WINCOME for the OECD subsample are now very large and become insignificant. The marginal effect of WAGE on CORR (computed in the same way as in Figure 4.1) is also insignificant. For the non-OECD subsample, however, the marginal impact of WAGE on CORR remains very much the same as in Figure 4.1, although the corresponding coefficients are less significant and smaller. This supports our finding that government wages only have a negative impact on corruption in relatively poor countries. Another noticeable change when the sample is split is that the age of democracy no longer has the inverted U-shape impact on corruption. This may reflect the limited variation in DEMAGE and its squared term within each subsample.

4.5 Conclusions

The impact of government wages on corruption is moderated by the level of per capita income. When income per capita is relatively low, higher government wages reduce corruption. This negative impact reduces as the level of income increases, and eventually becomes positive, though insignificant. Intuitively, petty corruption is more prevalent in poor countries, and well-paid bureaucrats forgo such type of corruption. However, when income is higher, petty corruption becomes less important. Grand corruption, involving more secret transactions that violate the laws and regulations, becomes prevalent. This type

of corruption brings about larger revenues that outweigh any realistic compensation package to the corrupted bureaucrats. It is also more difficult to detect. To combat the latter form of corruption, increasing government wages might not be efficient.

Our results are robust, even when we use an alternative (micro-based) measure of corruption. The impact of government wages on corruption is significant also if we lag our government wage indicator in order to deal with possible reverse causality. Likewise, using latitude instead of income to deal with multicollinearity problems does not change our main results. Of course, taking the lags of potentially endogenous variables and using latitude as a proxy for income are not perfect solutions to the econometric problems. Still, the robustness tests indicate that our results are not spurious.

Several policy implications can be drawn from this study. Higher government wages only reduce corruption in low-income countries. Government wages may not be an efficient policy tool to reduce corruption in upper middle- or high-income countries with a relatively high level of corruption, such as Greece and Italy. In low-income countries, increasing wages may substantially reduce corruption.

Just as an indication, an increase in average government wages from 100% to 200% of the average wages in the manufacturing industry leads to a decrease of about one point in corruption for countries with an income level between $ 1000 and $ 2000 (in 2012 prices). This drastic pay rise which, in many cases, is equivalent to doubling government wages, seems to be unrealistic. However, this is what happened in successful anti-corruption examples such as Singapore, Hong Kong and more recently, Da Nang, a city in central Vietnam.[13] A reduction of corruption in combination with other policy reforms can improve the investment climate substantially, moving a country to a new equilibrium with less corruption and more productive economic activities. Our finding is in contrast with theoretical studies arguing that governments in highly corrupted countries should pay low wages and maintain a corrupt bureaucracy (Besley and McLaren, 1993; Chang and Lai, 2002). The results of our study suggest that higher government wages should be used to combat corruption in the poorest and most corrupted countries.

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[13] In Vietnamese: http://vnexpress.net/gl/xa-hoi/2012/03/da-nang-ho-tro-csgt-5-trieu-dong-moi-thang/. The city authority decided to pay an extra 5 million VND per month to each policeman to stop traffic bribery. This pay rise is equivalent to some 2 times the then average manufacturing wages in Vietnam. However, it aimed at a small fraction of government employees, i.e. traffic police.

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4.7 Appendices

4.7.1 Appendix 4.A. Sources and summary of all variables

Variable	Obs	Mean	Min	Max	Definition and sources
CORR	930	2.69	0	6	ICRG corruption, available for purchase at http://www.prsgroup.com/icrg.aspx
WAGE	1076	1.3	0.38	3.07	The ratio of government to manufacturing wages, available at http://www.levanhab28.com/
INCOME	1076	9.4	6.67	11.37	The natural logarithm of GDP per capita (in 2012 international dollars), available from the World Bank's World Development Indicators (WDI) database
WINCOME	1076	12.21	2.89	26.83	The product of WAGE and INCOME
DEM	1014	7.11	-10	10	The revised Polity2 score available at http://www.systemicpeace.org
POLAR	1038	2.56	0	8	A dummy which equals 1 if a country is classified as highly polarized by Beck et al. (2001), as updated in 2010 and available at www.worldbank.org
DEMAGE	1038	13.09	0	64	Age of the democracy, the number of consecutive years since the year the country is classified a democracy from 1930 until now. Following Treisman (2007), we classify a country as democratic if the executive electoral competitiveness index produced by Beck et al. (2001) is larger than or equal to 6.5. The variable is rescaled to 10 years to prevent the magnitude of the corresponding estimated coefficients from becoming too small.
DEMAGESQ	1040	0.32	0	1	The square of DEMAGE
MIL	1028	0.02	0	1	A dummy which equals 1 if the chief executive is at the same time an army officer; source: Beck et al. (2001)
GOVSIZE	1076	0.17	0.03	0.54	Total final general government consumption as a percentage of GDP, provided by the WDI. This variable is further divided by 100 to prevent the magnitude of the corresponding estimated coefficient from becoming too small.
TRADE	1076	0.87	0.14	3.2	Total import and export as a percentage of GDP, provided by the WDI. This variable is further divided by 100 to prevent the magnitude of the corresponding estimated coefficient from becoming too small.
GOVSTAB	930	8.32	3.33	12	ICRG government stability score
BURQUAL	930	2.69	0	4	ICRG bureaucratic quality score
GEO1*	1076	0.32	0	1	A dummy equal to 1 if a country is in the Eastern Europe and Post Soviet Union (Including Central Asia)
GEO2*	1076	0.23	0	1	A dummy equal to 1 if a country is in the Latin America region, including Cuba, Haiti and The Dominican Republic
GEO3*	1076	0.04	0	1	A dummy equal to 1 if a country is in the North Africa and Middle East, including Israel, Turkey and Cyprus
GEO4*	1076	0.04	0	1	A dummy equal to 1 if a country is in the Sub-Saharan Africa
GEO5*	1076	0.29	0	1	A dummy equal to 1 if a country is in the Western Europe and North America, including Australia and New Zealand
GEO6*	1076	0.03	0	1	A dummy equal to 1 if a country is in the in East Asia, including Japan and Mongolia.
GEO7*	1076	0.02	0	1	A dummy equal to 1 if a country is in the Southeast Asia Region
GEO8*	1076	0	0	1	A dummy equal to 1 if a country is in the South Asia Region
LEGOR1*	1062	0.16	0	1	A dummy equal to 1 if a country has the English Common Law origin
LEGOR2*	1062	0.41	0	1	A dummy equal to 1 if a country has the French Commercial Law origin
LEGOR3*	1062	0.35	0	1	A dummy equal to 1 if a country has the Socialist/Communist Law origin
COLUK*	1076	0.1	0	1	A dummy equal to 1 if a country was formerly a United Kingdom's colony
COLFR*	1076	0.01	0	1	A dummy equal to 1 if a country was formerly a French colony
COLSP*	1076	0.21	0	1	A dummy equal to 1 if a country was formerly a Spanish colony
LAT*	1062	36.6	1	65	The absolute value of the latitude of the capital city.

* Collected from various sources and available at the Quality of Government Institute, Gothenburg University

4.7.2 Appendix 4.B. List of countries included in this chapter

No.	Country	Observations	No.	Country	Observations
1	Albania	5	39	Italy	14
2	Algeria	4	40	Jamaica	11
3	Argentina	19	41	Jordan	16
4	Armenia	12	42	Kazakhstan	11
5	Australia	9	43	Latvia	12
6	Austria	15	44	Lithuania	12
7	Azerbaijan	11	45	Mexico	16
8	Belarus	2	46	Moldova	13
9	Belgium	12	47	Mongolia	7
10	Bolivia	12	48	Netherlands	15
11	Brazil	19	49	New Zealand	19
12	Bulgaria	15	50	Nicaragua	3
13	Canada	19	51	Norway	11
14	Chile	9	52	Panama	17
15	China	19	53	Paraguay	13
16	Colombia	14	54	Peru	14
17	Costa Rica	8	55	Philippines	10
18	Croatia	12	56	Poland	17
19	Cyprus	13	57	Portugal	14
20	Czech Republic	16	58	Qatar	4
21	Denmark	13	59	Romania	17
22	Dominican Republic	13	60	Russian Federation	8
23	Ecuador	13	61	Slovakia	18
24	Egypt	4	62	Slovenia	13
25	El Salvador	16	63	South Africa	10
26	Estonia	13	64	Spain	14
27	Finland	14	65	Sweden	7
28	France	15	66	Switzerland	8
29	Germany	15	67	Taiwan	4
30	Greece	14	68	Tanzania	3
31	Guatemala	5	69	Thailand	3
32	Guyana	5	70	Uganda	3
33	Honduras	19	71	Ukraine	12
34	Hungary	18	72	United Kingdom	21
35	India	3	73	United States	21
36	Indonesia	2	74	Uruguay	17
37	Ireland	15	75	Venezuela	17
38	Israel	5	76	Vietnam	6

4.7.3 Appendix C. Model specification and estimation results based on the firm level data.

Following Cameron and Trivedi (2005), the perception of the top managers on corruption is modeled as a latent process:

$$\boldsymbol{y^* = \tau C_{it} + \kappa F_{ijt} + \alpha_{1i} + T_1 + \zeta_{ijt}} \qquad (\boldsymbol{4.C.1})$$

where i and j denote country and firm, C is a set of country level factors including $WAGE$, $INCOME$, $WAGE \times INCOME$ and all control variables included in the model in column (6) of Table 4.3. F is the set of firm level factors. α_{1i} and T_1 are vectors of country and time dummies. ζ_{ijt} is the error term which follows the standard normal distribution.

In practice, we do not observe y^*. Instead, we only observe the categorical variable on the rating by top managers, y, which takes the value j $(j = 0, \dots, 4)$, according to the following pattern:

$$\boldsymbol{y = j}$$

iff

$$\boldsymbol{\mu_{j-1} \leq y^* < \mu_j} \qquad (\boldsymbol{4.C.2})$$

where $\mu_{-1} = -\infty$ and $\mu_4 = +\infty$. The coefficients τ and κ in Equation $(4.C.1)$ can still be estimated consistently using the Ordered Probit model of the form:

$$\begin{aligned} \boldsymbol{P[y = j]} \quad &= \boldsymbol{\Phi\left[\mu_j - \left(C_{it} + F_{ijt} + \alpha_{1i} + T_1\right)\right]} \\ &- \boldsymbol{\Phi\left[\mu_{j-1} - \left(C_{it} + F_{ijt} + \alpha_{1i} + T_1\right)\right]} \end{aligned} \qquad (\boldsymbol{4.C.3})$$

When $y = 0$, the model in Equation $(4.C.3)$ reduces to:

$$\boldsymbol{P[y = 0] = \Phi\left[\mu_0 - \left(C_{it} + F_{ijt} + \alpha_{1i} + T_1\right)\right]} \qquad (\boldsymbol{4.C.4})$$

When $y = 4$, the model in Equation $(4.C.3)$ reduces to:

$$\boldsymbol{P[y = 4] = \Phi\left[\mu_4 - \left(C_{it} + F_{ijt} + \alpha_{1i} + T_1\right)\right]} \qquad (\boldsymbol{4.C.5})$$

Table 4.6 presents the summary of the firm level variables, while Table 4.7 presents the full estimation results.

Similar to the analysis in Section 4.1, we also compute the marginal impact of $WAGE$ on y^* as well as its 95% confidence interval. The results are presented in Figure 4.2. The figure shows that the marginal impact of $WAGE$ on y^* in Equation (4.C.1) is only significantly different from zero when the level of income per capital is 10,534 dollars or lower.

Table 4.6. Summary and definition of the firm level variables to support the estimation in column (5), Table 4.4

Variable	Obs	Mean	Std. Dev.	Min	Max	Definition
Corruption as an obstacle	38,335	1.56	1.42	0	4	Answer to the question "Do you think that corruption are No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?"
FIRMAGE	38,335	0.19	0.18	0	3.1	The number of years since the year a firm started operation in a country. The variable is rescaled by dividing by 100 to prevent the estimated coefficient from becoming too small.
FIRMEXPORT	38,335	0.23	0.42	0	1	A dummy equal 1 if a firm export
FIRMOWN1	38,335	0.13	0.33	0	1	A dummy equal 1 if a firm is wholly or partly owned by foreign individuals or entities
FIRMOWN2	38,335	0.04	0.2	0	1	A dummy equal 1 if a firm is wholly or partly owned by the government
FIRMLEGAL1	38,335	0.52	0.5	0	1	A dummy equal 1 if a firm is publicly listed
FIRMLEGAL2	38,335	0.07	0.25	0	1	A dummy equal 1 if a firm is a private limited company
FIRMLEGAL3	38,335	0.21	0.41	0	1	A dummy equal 1 if a firm is a sole proprietary firm
FIRMSIZE1	38,335	0.48	0.5	0	1	A dummy equal 1 if a firm employs between 5 and 19 people
FIRMSIZE2	38,335	0.3	0.46	0	1	A dummy equal 1 if a firm employs between 20 and 99 people
FIRMLOC1	38,335	0.2	0.4	0	1	A dummy equal 1 if a firm is located at a location with a population of between 250,000 and 1 million
FIRMLOC2	38,335	0.14	0.35	0	1	A dummy equal 1 if a firm is located at a location with a population of more than 1 million people
FIRMLOC3	38,335	0.31	0.46	0	1	A dummy equal 1 if a firm is located a the capital city of the country

Table 4.7. The impact of government wages on corruption based on firm level data

Country Level		**Firm Level**	
Variable	Estimates	Variable	Estimates
(1)	(2)	(3)	(4)
WAGE	-4.11*	FIRMAGE	-0.06
	(2.20)		(0.00)
INCOME	-0.44	FIRMEXPORT	0.02
	(0.45)		(0.02)
WINCOME	0.39*	FIRMOWN1	-0.06***
	(0.24)		(0.02)
DEM	-0.01	FIRMOWN2	-0.25***
	(0.04)		(0.05)
DEMAGE	-0.74***	FIRMLEGAL1	0.05**
	(0.24)		(0.02)
DEMAGESQ	-0.09	FIRMLEGAL2	0.03
	(0.07)		(0.03)
GOVSIZE	0.06***	FIRMLEGAL3	-0.01
	(0.02)		(0.03)
TRADE	0.01***	FIRMSIZE1	0.05**
	(0.00)		(0.02)
POLAR	-0.02	FIRMSIZE2	0.07***
	(0.07)		(0.02)
BURQUAL	0.00	FIRMLOC1	0.05*
	(0.02)		(0.03)
GOVSTAB	0.03	FIRMLOC2	-0.01
	(0.08)		(0.04)
MIL	1.00*	FIRMLOC3	0.10***
	(0.60)		(0.02)

Notes: This table shows the estimation results for Equation (4.4). Columns (2) and (4) present the estimates of the coefficients of the country and firm level factors, respectively. *, ** and *** indicate significance level of 10, 5 and 1% respectively. Country and time fixed effects are included. The countries included in this analysis are Albania (2002, 2005), Argentina (2010), Armenia (2002, 2005, 2009), Azerbaijan (2002, 2005, 312), Brazil (2003, 2009), Bulgaria (2002, 2005, 2007, 2009). Chile (2010), China (2002), Colombia (2010), Costa Rica (2010), Croatia (2002, 2005, 2007), Czech Republic (2002, 2005, 2007), Dominican Republic (2005, 2010), Ecuador (2010), El Salvador (2003, 2010), Estonia (2002, 2005, 2009), Germany (2005), Greece (2005), Guatemala (2003), Honduras (2003, 2010), Hungary (2002, 2005, 2009), Indonesia (2009), Ireland (2005), Kazakhstan (2002, 2005, 2009), Latvia (2002, 2005, 2009), Lithuania (2002, 2005, 2009), Moldova (2002, 2003, 2005, 2009), Mongolia (2009), Nicaragua (2010), Panama (2010), Paraguay (2010), Peru (2010), Philippines (2009), Poland (2002, 2003, 2005, 2009), Portugal (2005), Romania (2002, 2005, 2009), Russian Federation (2005, 2009), Slovakia (2002, 2005, 2009), South Africa (2003, 2007), Spain (2005), Ukraine (2002, 2005, 2008), Uruguay (2010) and Venezuela (2010).

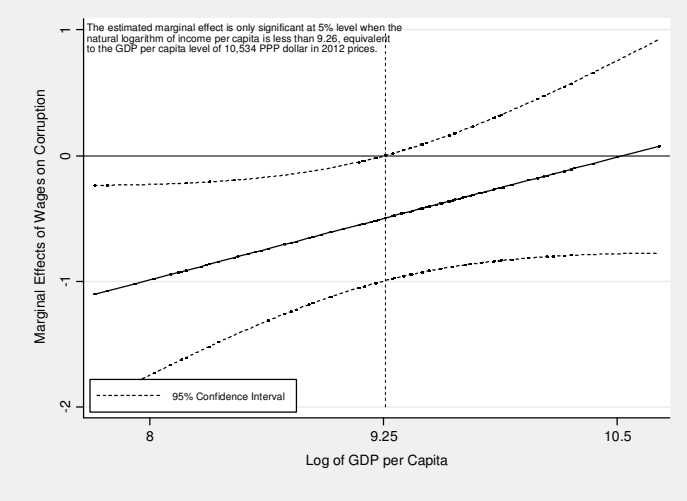

Figure 4.2. Marginal impact of government wages on corruption based on the firm level data

Chapter 5
The impact of inter-industry wage differentials on corruption and red tape: New firm-based evidence

5.1 Introduction[1]

Corruption is one of the most severe obstacles for firms' operations in many countries. Still, firms within the same country - which therefore share the same institutional environment - often pay different amounts of bribes and have different perceptions as to whether corruption is an obstacle to their operation. Several explanations have been suggested in the literature. Svensson (2003) argues that government bureaucrats act as price discriminators and determine the price of public services in a discretionary manner to maximize their income from corruption. More profitable firms are targeted and have to pay a larger amount of money on bribery. Another explanation for why firms face different levels of corruption is that firms in less competitive industries are forced to pay more bribes because corruptible bureaucrats know the distribution of the monopoly rents (Bliss and Di Tella, 1997). Finally, Alexeev and Song (2013) argue that competition induces more corruption because firms have to compete with each other for the distribution of public services.

Red tape, defined as completely pointless bureaucratic procedures that one has to endure when dealing with the bureaucracy (Banerjee, 1997), is another equally severe problem in many countries. It is the result of government (over-)regulation and is often abused by corrupted officials as a means to corrupt. Red tape creates burdens on the firms' operations and forces them to pay bribes. Corruptible government officials have an incentive to create red tape by making regulatory compliance artificially more costly or public services artificially scarcer in order to extract further bribes (Rose-Ackerman, 2004). Guriev (2004) shows that corruption leads to a level of red tape that is higher than the socially optimal level, while Banerjee (1997) demonstrates that red tape is deliberately created by bureaucrats in order to make money, and that the level of red tape is higher in relatively poor countries. Kaufmann (1997) finds that firms that spend more on bribery also face more red tape.

This chapter investigates the impact of wage differences across industries and countries on red tape and corruption. As explanatory variable, we will use the ratio of government wages

[1]This chapter is based on Le, V.H., Dietzenbacher, E., de Haan, J., 2013. The impact of inter-industry wage differentials on corruption and red tape: New firm-based evidence. University of Groningen, The Netherlands.

and the average wages in each of the industries that are considered. This is because the relative government wages are hypothesized to be the cause of corruption and determine which industry is targeted. Previous studies such as Dutt (2009), Le et al. (2013a), and Van Rijckeghem and Weder (2001) have used relative government wages that were defined as the ratio of government wages to the wages in the manufacturing industry. Such measure captures the relative wages of government employees while it helps avoiding the difficulty of comparing absolute values of wages across countries. However, it focuses on the manufacturing industry only and ignores that the wage gap (and thus the incentive to corrupt) may differ across industries. In this chapter we therefore focus on all industries classified according to the International Standard Industrial Classification of All Economic Activities, revision 3 (ISIC 3). Our relative government wage indicator (defined as the ratio of government wages and the average wages of each of the ISIC 3 industry) thus varies from one industry to the other. The higher the wages of an industry are, the lower the value of the relative government wage indicator is. The indicator thus reflects the industry wage differentials in each country.

A large body of literature finds that industrial wage differences within a country are driven by the profitability of the firms within an industry (Genre et al., 2011; Gittleman and Wolff, 1993; Krueger and Summers, 1988). On the other hand, firm-level studies have found that government bureaucrats and politicians act as price-discriminators in terms of bribery bargaining (Svensson, 2003). As a result, corrupt bureaucrats may consider inter-industry wage differentials as information in deciding which firms to target. When inter-industry wage differentials serve as a channel of information for the opportunities to extract bribes, the bureaucrats will have the incentive to "rattle" the firms that they think are most capable of paying bribes. That is, firms in an industry with relatively high wages and, therefore, a low relative government wage indicator.

The measures of corruption and red tape in this study are both perception-based and experience-based. The data are collected via worldwide surveys at the firm level, carried out by the World Bank's Enterprise Survey Unit. The perception-based measures are the responses by top managers to questions about how much of an obstacle government regulations and corruption are to the firms' day-to-day operations. The experience-based measures are the actual amount of "unofficial payment" that top managers think "firms like theirs" have to pay government officials to "get things done", and the time devoted to dealing with government procedures by senior managers. The database covers a large number of firms from mostly developing countries. The surveyed firms are representative of an economy's private sector and can be classified into ISIC 3 industries. The sample used consists of 43,568 firms from 52 countries.

We test our hypothesis that firms from high-wage industries face more corruption and red tape by modeling red tape and corruption as nonlinear functions of the relative wage indicator and an interaction term between this indicator and the level of income per capita. By including the interaction term, the impact of inter-industry wage differentials is moderated by the level of income per capita. The interaction term accounts for the theoretical prediction of Banerjee (1997) that the level of red tape is higher in relatively poor countries. It is also motivated by the finding of Le et al. (2013a) that relative government wages are more strongly related to corruption in low-income countries than in high-income countries. The explanation given is that higher government wages only reduce petty corruption (which involves small amounts of money), a phenomenon that is common,

in particular, at low levels of economic development. Built on these findings, the relationship between our indicator of relative government wages, and red tape and corruption is expected to be negative in low-income countries, i.e. firms from higher-wage industries thus having a lower indicator, face more red tape and spend more on bribes.

However, petty corruption is less common in rich countries in which bureaucrats are also less likely to use red tape as a measure to rattle firms in order to extract bribes. Therefore, we expect no relationship between inter-industry wage differentials and corruption when the income level is relatively high. Furthermore, high-wage firms are often more profitable and therefore have enough resources to meet costly government regulations. As a result, they are less likely to complain about government regulations. Therefore, the relationship between relative government wages and red tape may be positive in relatively rich countries, i.e. high wage firms complain less about government regulation.

We use several econometric models and control for country and time specific effects as well as firm-level characteristics. In low-income countries, we find strong evidence that top managers in high-wage industries (when compared to those low-wage industries) are more likely to view government regulations and corruption as obstacles to their firms' operations. Such high-wage firms pay a larger amount of their annual sales on corruption and their senior management also spends significantly more time on dealing with government regulations.

The chapter will proceed as follows. Section 5.2 presents our motivation to explore the relationship between inter-industry wage differentials and corruption and red tape. Section 5.3 presents the econometric models and data sources. The findings are presented in Section 5.4 while Section 5.5 concludes.

5.2 Related literature and motivation

The most important line of research related to this study deals with the relationship between government wages and corruption, which can be defined as the abuse of public office for private gain (Rose-Ackerman, 2004). A major reason for government bureaucrats to involve in corruption is that their wages are so low that they have to "abuse" their power to meet the subsistence level (Feinberg, 2009; Klitgaard, 1989; Stasavage, 1999). A natural question is whether raising government wages will eradicate, or at least reduce, corruption. Several theoretical studies such as Becker and Stigler (1974), Bond (2008), Bose (2004), UlHaque and Sahay (1996), and Van Rijckeghem and Weder (2001) suggest that this is the case. Higher government wages make government bureaucrats feel being fairly treated and they may withhold from corrupt activities which would reduce corruption. Selfish government employees who aim at maximizing their income may also find it no longer optimal to corrupt because higher wages increase the economic loss of losing a well-paid government job in case of detection. Finally, higher government wages will attract better workers to the government and prevent high-quality government employees from moving

to the private sector. The quality of the bureaucracy will then improve and the government may become better at controlling corruption.[2]

Some empirical studies find that higher government wages reduce corruption (Dutt, 2009; Van Rijckeghem and Weder, 2001) while some others report no significant relationship between government wages and corruption (Panizza, 2001; Treisman, 2007). In these studies relative government wages are generally defined as the ratio of government wages and the wages of a benchmark sector, such as manufacturing. Alternatively, GDP per capita may be used as the denominator. This practice dates back to the seminal research by Heller and Tait (1984). In a recent study covering a large number of countries over the late 1980s-2010 period and using data drawn from micro-based surveys, Le et al. (2013a) find that government wages only have a negative impact on corruption in countries with a relatively low income per capita. Their explanation is that corruption in poor countries mainly consists of petty corruption which government bureaucrats in high income countries are more likely to forgo because the relatively small amount of money gained may not be worth the effort.[3] Also, petty corruption is easier to detect and government employees in relatively rich countries may not find the gains worth the risk of detection.

There are several reasons why inter-industry wage differentials may be related to the level of red tape and corruption. First, the inter-industry wage structure is partly determined by the profitability of each industry (Du Caju et al., 2010; Lawrence, 1986). Studies in the last decades also find that the structure is relatively stable over time in both developed and developing countries (Erdil and Yetkiner, 2001), even in the face of major macroeconomic shocks (Arbache et al., 2004). Therefore, the differences in relative government wages across industries may serve as a signal about the profitability of firms. Selfish government agents who aim to maximize their income may use this information to screen and filter out firms which are most capable of paying bribes. Once certain groups of firms are targeted, bureaucrats can use their discretionary power to increase red tape in order to extract bribes. So firms in high-wage industries will face more red tape and may have to buy their way out via corruption.

Second, the fair-wage hypothesis suggests that government bureaucrats forgo opportunities to extract bribes once they are paid a wage level they perceive as fair. However, the feeling of being fairly paid is a subjective matter and whether or not a bureaucrat feels that he is fairly paid may depend on the reference (Mas, 2006). A similar issue has been discussed in the literature on happiness. Based on a survey of this literature, Clark et al. (2008) conclude that individuals feel happier when their income is relatively higher than the income of comparable people. In another study, Clark et al. (2010) report that workers who receive an income at the higher end of the relevant income distribution also exert more effort to fulfill their duty. These results suggest that bureaucrats may feel less guilty if they extract bribes from firms in high-wage industries.

[2] At the same time, studies such as Besley and McLaren (1993) and Macchiavello (2008) argue that paying high government wages to combat corruption is very costly or inefficient.

[3] Examples of petty corruption are road bribery and public fund embezzlement as documented in Bardhan (2006) and Akombi (2009).

Third, government employees may differ in terms of motivation (Macchiavello, 2008). Some may be highly motivated to work for the government and serve the society. However, others may choose to work for the government because of the possibility to corrupt. The latter type of bureaucrats will also seek to work for those government agencies offering the best opportunities to extract bribes. Therefore, selfish government employees are more likely to regulate high-wage industries, because the profitability of such industries might be a good signal that firms are able to pay bribes. As a result, firms in high-wage industries may face more red tape and spend more on bribery.

5.3 Data and the estimation approach

5.3.1 The World Bank's Enterprise Survey

The Enterprise Survey database[4] focuses on a wide range of issues, such as infrastructure services, sales and supplies, and business-government relationships. We focus on two different sets of questions. The first one aims at capturing the top managers' perceptions of dealing with the government, and the other set of questions aims at measuring the actual cost of corruption and red tape that firms incur. With respect to the perception measures, top managers are asked to judge how much of an obstacle corruption and government regulations are to their firms' day-to-day operations. Besides a question on general corruption, there are four questions on the extent to which labor regulation, courts/legal system, business licensing and operating permits, and tax administration are obstacles to the firm's operations.[5] So we have one perception-based measure of corruption and four perception-based measures of red tape. The actual cost of corruption is obtained from top managers' response to the question how much gifts and informal pay, in terms of annual sales, firms like theirs have to pay "to get things done". Finally, the actual cost of red tape is measured as the reported percentage of their time that senior management spent on dealing with government regulations.

Each type of measurement has some advantages but also suffers from shortcomings. While the top managers are likely to answer questions on their perceptions, their responses may be biased toward their most recent experience with the government (Kaplan and Pathania, 2010). Managers may not find that labor regulations are burdensome if no government inspector visited their firm recently, while others may perceive that obtaining an operating permit is very difficult because they recently faced that problem. Perception measures are subjective and it is difficult to know whether perceptions reflect the actual situation or not.

With respect to the experience-based measures, the question on the actual amount of corruption gives us a very concrete measure of the cost of corruption but many managers refuse to answer such questions or give a false response because they are afraid of retaliation (Jensen et al., 2010). The measure of actual red tape stands out to be the most

[4] Available at http://www.enterprisesurveys.org/

[5] Another aspect of red tape is customs and trade regulations, which turned out to be insignificant. Perhaps, this is because only 23% of the sampled firms in our analysis export directly or indirectly, while 77% of the firms do not have any experience with customs regulations. Results are available on request.

reliable because it is comparable between firms and it is less sensitive than the question on corruption so that respondents are more likely to give true answers. Table 5.1 presents the name of the dependent variables as well as their corresponding survey questions. For the questions regarding top managers' perceptions of government regulation, the resulting variables are categorical, running from 0 to 4, where higher values indicate more obstacles. The experience-based variables are continuous. Corruption cost is the reported percentage of annual sales spent on corruption, while Red tape cost is the reported percentage of senior management's time spent on dealing with government regulations.

Table 5.1. The definitions of the dependent variables

Variables	Definition
Actual cost measures:	
Red Tape Cost	Answer to the question "In a typical week over the last 12 months, what percentage of total senior management's time was spent in dealing with requirements imposed by government regulations? [Senior management means managers, directors, and officers above direct supervisors of production/sales workers. Some examples of government regulations are taxes, customs, labor regulations, licensing and registration, including dealings with officials and completing forms.]"
Corruption Cost	Answer to the question "We've heard that establishments are sometimes required to make gifts or informal payments to public officials to "get things done" with regard to customs, taxes, licenses, regulations, services etc. On average, what percent of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials for this purpose?"
Perception measures:	
Corruption	Answer to the question "Do you think that corruption is No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?"
Courts/Legal System	Answer to the question "Do you think that the legal system is No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?"
Labor Regulation	Answer to the question "Do you think that labor regulations are No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?"
Business Licensing & Operating Permits	Answer to the question "Do you think that the business licensing and permit are No Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?"
Tax Administration	Answer to the question "Do you think that the tax administration is No Obstacle, a Minor Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?"

Banerjee (1997), Bose (2004) and Guriev (2004) suggest that these measures are inter-related. To extract petty bribes, corrupt bureaucrats may raise the level of red tape. Artificially high levels of red tape require top managers from high-wage firms to spend more time on dealing with government regulations and they will find government regulations a severe obstacle to their firm's operations. Consequently, firms have to pay more bribes to overcome the red tape and their top managers will also report higher bribery expenditure percentages.

5.3.2 The empirical model

Given the differences in the nature of the dependent variables in our study, we employ two different econometric methods to estimate the relationship between inter-industry wage differentials and corruption and red tape, namely the Ordered Probit model, and the Tobit model. First, we model the managers' perceptions of each aspect of government regulation as a latent variable, y_n^*, which is a function of our variable of interest and a set of control variables of the following form:

$$\begin{aligned} \boldsymbol{y^*_{nijkt}} &= \boldsymbol{\beta_n WAGE_{ijt}} + \boldsymbol{\delta_n}\left(\boldsymbol{WAGE_{ijt}} \times \boldsymbol{INCOME_{it}}\right) \\ &+ \boldsymbol{\rho_n X_{nijkt}} + \boldsymbol{\sigma_n Z_{it}} + \boldsymbol{\varepsilon_{nijkt}} \end{aligned} \quad (\mathbf{5.1})$$

where y_n^*, with $n\ (= 1, 2, .., 5)$, indicates the different dependent variables that are taken into consideration. That is, the top managers' perception of corruption and of the obstacles related to: the legal system, labor regulations, the business licensing and operating permits, and the tax administration. The indexes i, j, k and t stand for country, industry, firm and the surveyed year, respectively. As mentioned before, $WAGE_{ijt}$ is an indicator of relative government wages which is constructed as the ratio of government wages to the average wages of the industry that a firm is operating in. $INCOME_{it}$ gives income, measured as the natural log of GDP per capita in 2012 PPP prices. X_{ijkt} is a set of firm-level control variables and ε_{nijkt} is the error term which is assumed to follow a standard normal distribution. Z_{it} represents country-year dummies. These dummies will take into account all differences between countries as well as the variation within each country over time. For this reason, we do not need to control for country-specific variables that potentially affect red tape and corruption.

The coefficient of $WAGE$ is expected to be negative for the reasons outlined in the previous section. The interaction term $WAGE_{ijt} \times INCOME_{it}$ is the product of the relative government wage indicator and the income variable. This interaction term is included in our model to capture the fact that bureaucrats in poor countries are more likely to use the relative wage information to target high-wage firms to extract petty bribes than bureaucrats in rich countries (Le et al., 2013a). It is also consistent with the theoretical prediction in Banerjee (1997) that red tape is more likely to be abused as a means to extract illegal income in poor countries. We expect the marginal impact of $WAGE$ on y_n^* to be negative at low-income levels. When the income level is relatively high, we do not expect any significant relationship between inter-industry wage differentials and corruption because petty corruption is not common in rich countries. However, the impact of $WAGE$ on the top managers' perception on government regulation in rich countries can be positive because high wage firms are often more profitable and have enough resources to meet the costly regulations and rules.

In practice, we do not observe y_n^* directly. Instead, we have the categorical variable, y_n, which is the response by top managers to the first 5 questions listed in Table 5.1. These categorical responses are determined by the underlying continuous variable y_n^*. The observed categorical variable will take the value l, $(l = 0, 1, 2, 3, 4)$, if:

$$\boldsymbol{\mu_{nl-1} \leq y_n^* < \mu_{nl}}$$

where $\mu_{n-1} = -\infty$ and $\mu_{n4} = +\infty$. Let $A \equiv \{\beta_n WAGE_{ijt} + \delta_n(WAGE_{ijt} \times INCOME_{it}) + \rho_n X_{nijkt} + \sigma_n Z_{it}\}$, then the coefficients β_n and δ_n in Equation (5.1) can be estimated in a consistent manner by using the Ordered Probit model of the following form (Cameron and Trivedi, 2005):

$$\begin{aligned} \boldsymbol{P[y_n = l]} &= \boldsymbol{P[\mu_{nl-1} \leq y_n^* \leq \mu_{nl}]} \\ &= \boldsymbol{P\left[\mu_{nl-1} \leq A + \varepsilon_{nijkt} \leq \mu_{nl}\right]} \\ &= \boldsymbol{P\left[\mu_{nl-1} - A \leq \varepsilon_{nijkt} \leq \mu_{nl} - A\right]} \\ &= \boldsymbol{\Phi[\mu_{nl} - A] - \Phi[\mu_{nl-1} - A]} \end{aligned}$$

Two special cases are $y_n = 0$ and $y_n = 4$. The probability that y_n takes the value of 0 can be simplified as:

$$\begin{aligned} \boldsymbol{P[y_n = 0]} &= \boldsymbol{P[-\infty \leq y_n^* \leq \mu_{n0}]} \\ &= \boldsymbol{P\left[A + \varepsilon_{nijkt} \leq \mu_{n0}\right]} \\ &= \boldsymbol{P\left[\varepsilon_{nijkt} \leq \mu_{n0} - A\right]} \\ &= \boldsymbol{\Phi[\mu_{n0} - A]} \end{aligned}$$

In a similar manner, the probability that $y_n = 4$ can be written as:

$$\begin{aligned} \boldsymbol{P[y_n = 4]} &= \boldsymbol{P[y_n^* \geq \mu_{n3}]} \\ &= \boldsymbol{P\left[A + \varepsilon_{nijkt} \geq \mu_{n3}\right]} \\ &= \boldsymbol{P\left[\varepsilon_{nijkt} \geq \mu_{n3} - A\right]} \\ &= \boldsymbol{1 - P\left[\varepsilon_{nijkt} \leq \mu_{n3} - A\right]} \\ &= \boldsymbol{1 - \Phi[\mu_{n3} - A]} \end{aligned}$$

where Φ is the standard normal cumulative distribution of the error term ε_{nijkt}. The interested parameters of this model can be estimated using the maximum likelihood estimator, with the log likelihood function specified as:

$$\boldsymbol{ln\ell_n} = \sum_{k=1}^{N} \sum_{l=0}^{4} \boldsymbol{v_{nl}\, ln\left[\Phi[\mu_{nl} - A] - \Phi[\mu_{nl-1} - A]\right]}$$

where v_{nl} is a dummy variable which takes the value of 1 if a top manager reports that indicator n take the value l, $(l = 0, 1, 2, 3, 4)$, and N is the size of the sample of surveyed firms.

Second, we investigate the relationship between inter-industry wage differentials and the actual cost of corruption and red tape, i.e. the actual amount of revenue spent on corruption and the actual percentage of time that senior management spent on dealing with government regulations, by specifying a linear regression equation:

$$y^*_{mijkt} = \beta_m WAGE_{ijt} + \delta_m(WAGE_{ijt} \times INCOME_{it}) + \rho_m X_{mijkt} + \sigma_m Z_{it} + \varepsilon_{mijkt} \quad (5.2)$$

where y^*_m, with $m = 1, 2,$,stands for our measures of the actual cost of corruption and the actual cost of red tape respectively.ε_{mijkt} is the random error term which is assumed to follow a normal distribution. Other variables are defined as before.

One problem with the linear regression model in Equation (5.2) is that we do not observe y^*_m directly. Instead, we observe a variable y_m which is equal to y^*_m if $y^*_m > 0$ and 0 if $y^*_m \leq 0$. In other words, the variables on the reported cost of corruption and red tape are censored from below at 0. Following Alexeev and Song (2013), we therefore employ the Tobit model which takes into account the probability that y^*_m is censored at 0 by adding a correction term to the log likelihood function of the ordinary least squares log likelihood function. The correction term is the probability that $y^*_m \leq 0$, which is (Cameron and Trivedi, 2005):

$$\begin{aligned} P[y_m = 0] &= P[y^*_m \leq 0] \\ &= P[B + \varepsilon_{mjkt} \leq 0] = P[\varepsilon_{mijkt} \leq -B] \\ &= P\left[\frac{\varepsilon_{mijkt}}{\sigma} \leq \frac{-B}{\sigma}\right] \\ &= \Phi\left[\frac{-B}{\sigma}\right] \\ &= 1 - \Phi\left[\frac{B}{\sigma}\right] \end{aligned}$$

where σ is the standard deviation of ε_{mijkt}, and $B \equiv \{\beta_m WAGE_{ijt} + \delta_m(WAGE_{ijt} \times INCOME_{it}) + \rho_m X_{mijkt} + \sigma_m Z_{it}\}$. β_m and δ_m in Equation (5.2) can be estimated consistently by maximizing the likelihood function of the following form:

$$ln\ell_m = \sum_{y_m=0} ln\left\{1 - \Phi\left[\frac{B}{\sigma}\right]\right\} + + \sum_{y_m>0} ln\left\{\frac{1}{\sigma}\varphi\left[\frac{y_m - B}{\sigma}\right]\right\}$$

where φ is the density function of a standard normal random variable.

5.3.3 Control variables

An important question is which firm-level variables should be included in X_{nijkt} and X_{mijkt} in equations (5.1) and (5.2). Given the lack of a clear theory and the interrelatedness between the dependent variables, we have chosen to include the same set of variables in both equations. These variables aim at controlling for different firm characteristics to ensure that the estimated impact of government wages on corruption and red tape is not biased. Following previous studies such as Alexeev and Song (2013), Fan et al. (2009), and

Svensson (2003) we include 6 groups of firm level characteristics as control variables. These are firm location, legal status, size, ownership, age, and export activity.

The location of a firm can affect its business opportunities as well as its profitability, which in turn will affect its ability and willingness to pay a bribe. Firms in more profitable locations, e.g. large cities, are also more likely to be targeted by government officials. We include three dummies to account for firms' location. $FIRMLOC1$, $FIRMLOC2$ and $FIRMLOC3$ take the value 1 if the firm is located in a city: with a population of 250,000 to 1 million people, with a population of more than 1 million people or that is the capital city, respectively. With respect to a firm's legal status, there are also three dummies which take the value 1 if a firm has the legal status of privately limited ($FIRMLEGAL1$), publicly listed ($FIRMLEGAL2$), or sole proprietary ($FIRMLEGAL3$). Firms with different legal statuses are subject to different regulations on information disclosure and may, therefore, have different perceptions on, and experiences with, red tape and corruption.

Svensson (2003) argues that small firms are less likely to pay bribes because it is easier for them to escape attention from corruptible officials. To control for this, we include two dummies which equal 1 if the size of the firm in terms of employment is between 5 and 19 ($SMALL$) or between 20 and 99 ($MEDIUM$). International investors, especially those from OECD countries, face extra regulations on corruption from home country authorities. As a result, we expect that foreign direct investment (FDI) firms are less likely to bribe. Government ownership provides firms with connections to authorities or access to resources that private firms can only get by bribing. Hence, enterprises partly owned[6] by the state might face less red tape and can avoid some form of bribery faced by private firms. To take these considerations into account, we construct two dummies: $OWNERSHIP1$ which takes the value of 1 if a firm is an FDI enterprise, and $OWNERSHIP2$ which takes the value of 1 if the firm is partly owned by the government.

$FIRMAGE$ and $FIRMEXPORT$ are the final explanatory variables. $FIRMAGE$ is the number of years since a firm started operation while $FIRMEXPORT$ is a dummy variable which is equal to 1 if a firm sells its products abroad.[7] Because new firms typically face more procedures to deal with, they may complain more about red tape and may have to pay more bribes. Similarly, exporting firms have to use more public services and may therefore have worse perceptions of and experiences with the government.

5.3.4 Data sources and descriptive analysis

Data on wages are taken from the worldwide database on industrial wages collected by Le et al. (2013b). This database provides the average wages for each of the 17 ISIC 3 industries for 126 countries over the late 1980s – 2011 period. One part of the data is obtained from international household survey databases, such as the World Bank Living Standard Measurement Study, the Luxembourg Income Study, or the one from the International Labor Organization. The other part of the data is obtained by studying countries' data archives. Next to the fact that survey data are more accurate than macro data obtained from statistical yearbooks (Le et al., 2013c), they also open a new path to

[6] 100% state-owned enterprises are excluded from the Enterprise Surveys.

[7] $FIRMAGE$ is divided by 100 so that the coefficient on $FIRMAGE$ does not become very small.

overcome the problem of missing data for developing countries, where reliable macro data on government wages and on employment are often lacking. We use data on wages for the public administration and the 9 industries that are included in the Enterprise Survey database.[8] The relative government wage indicator is defined as the ratio of the wages in public administration to the average wages of the ISIC 3 industry that a firm is operating in.

Table 5.2. Summary of the main variables

Variable	Obs	Mean	Standard Deviation	Min	Max
1. WAGE	43,568	1.49	0.38	0.20	3.16
2. INCOME	43,568	9.24	0.67	7.28	10.72
3. WAGE x INCOME	43,568	13.78	3.59	1.65	31.11
4. Corruption	41,184	1.55	1.41	0	4
5. Legal System	39,470	1.22	1.28	0	4
6. Labor Regulation	42,842	1.19	1.21	0	4
7. License and Permit	41,913	1.12	1.19	0	4
8. Tax Administration	42,639	1.52	1.25	0	4
9. Red tape cost	40,492	10.18	15.73	0	100
10. Corruption cost	28,300	1.12	3.86	0	100
11. FIRM AGE	43,568	0.18	0.18	0	3.10
12. EXPORTER	43,568	0.23	0.42	0	1
13. OWNERSHIP1	43,568	0.13	0.33	0	1
14. OWNERSHIP2	43,568	0.05	0.21	0	1
15. LEGAL1	43,568	0.50	0.50	0	1
16. LEGAL2	43,568	0.07	0.26	0	1
17. LEGAL3	43,568	0.23	0.42	0	1
18. SMALL	43,568	0.49	0.50	0	1
19. MEDIUM	43,568	0.30	0.46	0	1
20. LOCATION1	43,568	0.18	0.39	0	1
21. LOCATION2	43,568	0.13	0.34	0	1
22. LOCATION3	43,568	0.31	0.46	0	1

We first compute the relative government wages for all countries for which Le et al. (2013b) provide data. In the second step, this dataset is merged with the cleaned Enterprise Surveys dataset. We only retain firms with complete information on all explanatory variables and at least one dependent variable. The final sample consists of 43,568 firms from 52 countries.

Table 5.2 presents summary statistics for the main variables in our models. The relative government wage indicator varies between 0.2 and 3.16, with an average value of 1.49. There is also substantial variation in the perceptions of top managers on different aspects of government regulation. The average corruption perception score is about 1.55. Perception on tax administration has an average of 1.52, but the average scores on the extent to which business licensing and operating permits, labor regulation and the legal system are

[8] The 9 industries included in the Enterprise Survey database are: Mining and quarrying; Manufacturing; Electricity, gas and water supply; Construction; Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods; Hotels and restaurants; Transport, storage and communications; Financial intermediation; and Real estate, renting and business activities.

obstacles for firms' operations are only 1.12, 1.19 and 1.22, respectively. The response rate[9] to the questions regarding top managers' perception on corruption and red tape is always higher than 90%.

With respect to the actual cost of red tape, the response rate is also high, equal to 93.30%. About 31% of the respondents in our retained sample report that they spend no time on dealing with government regulation, while only 2% report that they spend more than 50% of their time on the issue. On average, senior managers who report a positive amount of time dealing with the government spend about 14.70% of their time on the issue, while the variation between these firms is relatively large, with a standard deviation of about 17.05%.

Table 5.3. Correlation of the main variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. WAGE	1																				
2. INCOME	-0.02	1																			
3. WAGE x INCOME	0.96	0.24	1																		
4. Corruption	0.11	-0.15	0.07	1																	
5. Legal System	0.05	-0.05	0.04	0.62	1																
6. Labor Regulation	0.10	0.09	0.12	0.35	0.40	1															
7. License and Permit	0.05	-0.05	0.05	0.42	0.44	0.40	1														
8. Tax Administration	0.03	-0.01	0.03	0.44	0.43	0.43	0.46	1													
9. Red tape cost	0.04	-0.05	0.03	0.18	0.18	0.14	0.13	0.12	1												
10. Corruption cost	-0.03	-0.10	-0.06	0.16	0.10	0.03	0.10	0.10	0.11	1											
11. FIRM AGE	0.04	0.08	0.06	0.00	0.04	0.09	0.00	0.00	0.06	-0.06	1										
12. EXPORTER	-0.02	0.06	0.00	0.00	0.05	0.08	0.02	0.02	0.05	-0.04	0.15	1									
13. OWNERSHIP1	-0.04	-0.04	-0.05	-0.03	0.00	0.01	0.01	-0.02	0.02	-0.02	-0.01	0.25	1								
14. OWNERSHIP2	-0.13	-0.08	-0.14	-0.07	-0.03	-0.05	-0.05	-0.05	-0.02	-0.02	0.18	0.01	-0.04	1							
15. LEGAL1	0.10	0.08	0.12	0.13	0.10	0.16	0.10	0.07	0.11	0.00	0.05	0.12	0.06	-0.22	1						
16. LEGAL2	-0.04	-0.01	-0.04	0.00	0.03	-0.02	0.00	-0.03	0.06	-0.01	0.19	0.06	0.03	0.34	-0.27	1					
17. LEGAL3	0.00	-0.04	-0.01	-0.08	-0.09	-0.13	-0.08	-0.05	-0.11	0.01	-0.16	-0.16	-0.13	-0.12	-0.54	-0.15	1				
18. SMALL	-0.01	0.09	0.01	-0.09	-0.10	-0.17	-0.08	-0.04	-0.15	0.03	-0.25	-0.28	-0.17	-0.10	-0.24	-0.17	0.34	1			
19. MEDIUM	0.03	-0.05	0.02	0.08	0.06	0.09	0.04	0.04	0.09	0.00	0.03	0.05	0.00	0.00	0.17	0.03	-0.17	-0.64	1		
20. LOCATION1	0.04	-0.01	0.04	0.02	-0.02	-0.01	-0.02	-0.01	0.01	-0.01	-0.01	-0.02	-0.03	-0.02	0.03	0.00	0.01	-0.02	0.03	1	
21. LOCATION2	0.01	-0.18	-0.04	0.03	0.01	0.05	0.02	0.01	0.03	0.00	0.02	0.00	0.03	0.03	0.00	-0.01	-0.04	-0.11	0.04	-0.18	1
22. LOCATION3	0.01	-0.07	0.00	0.05	0.04	0.02	0.04	0.01	0.04	0.03	0.04	0.03	0.07	0.00	0.07	0.02	-0.07	-0.03	0.00	-0.32	-0.26

With respect to the actual cost of corruption, firms reporting to pay bribes indicate that they have to incur about 3.99% of their annual sales "to get things done". There is substantial variation in the amount that firms pay, from about 0.001% to 100%, and the standard deviation of this variable is 6.44%. Most firms reporting a positive amount of bribery indicate that they have to pay an amount of about 10% or less and only 1% of the responding firms report that they have to pay more than 10%. However, we should emphasize that 35.07% of the surveyed firms refuse to answer this question. In our retained sample, only 28,300 out of 43,568 firms respond (equal to 64.96%) and only 7,952 firms report a positive amount of expenditure on bribes (equal to 18.25%). And, managers who answer may intentionally give the wrong information (Kraay and Murrell, 2013). The measurement of actual corruption cost is therefore probably the least reliable of our 7 measures used.

Table 5.3 presents the correlation between the main variables of our models. The correlation between $WAGE$ and the interaction term $WAGE \times INCOME$ is very high, equal to 0.96. This is because the variable $INCOME$, measured in natural logs, does not vary very much in our sample. The correlation between the variables capturing the top managers'

[9] The response rate in this section is calculated based on the original sample, before the observations with missing information are dropped.

perception of corruption and the extent to which regulation is regarded as an obstacle is relatively low. Also the correlation between actual corruption cost and top managers' perception of corruption and red tape is very low, varying from 0.02 to 0.16, suggesting the importance of studying the issue from different angles.

Another important result is that the correlation between $INCOME$ and different measures of corruption and red tape, presented in column (2) of Table 5.3, are mostly negative but relatively low. This is very different from the high correlation between $INCOME$ and measures of corruption and red tape at the country level as generally reported in the literature. Such difference suggests that there is a substantial variation of corruption and red tape facing firms within a country that cannot be captured by aggregate corruption measures.

5.4 Results

5.4.1 The relationship between inter-industry wage differentials and perceptions of corruption and red tape

Table 5.4. The impact of inter-industry wage differentials on the top managers' perception of corruption and red tape

Dependent Variable	MAJOR OBSTACLE TO FIRMS' OPERATION				
	Corruption	Legal System	Labor Regulation	Operating License	Tax Administration
(1)	(2)	(3)	(4)	(5)	(6)
WAGE	-1.07***	-0.80**	-1.64***	-1.24***	-1.41***
	(0.37)	(0.31)	(0.39)	(0.46)	(0.26)
WAGE x INCOME	0.11***	0.08**	0.17***	0.13***	0.16***
	(0.04)	(0.03)	(0.04)	(0.05)	(0.03)
FIRM AGE	-0.06	0.07*	0.02	-0.13***	-0.04
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
EXPORTER	0.02	0.05***	0.09***	0.04**	0.07***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
OWNERSHIP1	-0.05**	-0.02	-0.03	0.03	-0.05**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
OWNERSHIP2	-0.22***	-0.17***	-0.11**	-0.21***	-0.25***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)
LEGAL1	0.02	0.00	-0.01	0.01	0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
LEGAL2	-0.01	0.02	-0.06*	0.01	0.00
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LEGAL3	-0.03	-0.08***	-0.06**	-0.04**	-0.01
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
SMALL	0.06**	-0.09***	-0.25***	-0.08***	-0.03
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
MEDIUM	0.07***	-0.01	-0.07***	-0.03*	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
LOCATION1	0.04	0.01	0.02	0.02	0.04
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
LOCATION2	-0.00	0.01	-0.01	0.07	0.03
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
LOCATION3	0.10***	0.08***	0.01	0.07***	0.05**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	41,184	39,470	42,842	41,913	42,639
No. of surveys	104	104	104	104	104
No. of Countries	52	52	52	52	52
Pseudo R-squared	0.08	0.07	0.09	0.04	0.08

Notes: this table presents the estimation of Equation (5.1) using the ordered probit model. The column header indicates the name of the dependent variable. The standard errors reported in the parentheses are corrected for within country-year clustered effects. 104 country-year dummies are included. *,**,*** indicate a significant level of 10%, 5% and 1%, respectively.

Table 5.4 presents the estimation results for Equation (5.1). The heading of each column shows the dependent variable. So, column (2) shows the relationship between inter-industry wage differentials and top managers' general perceptions of corruption, column (3) shows the relationship between wage differentials and top managers' perceptions of obstacles in the legal system, and so on. The number of observations in each column differs due to data availability. The largest number of observations is 42,842 for the model for perceptions on labor regulations. The smallest sample is 39,470 for the model on perceptions of the legal system.

The signs of the coefficients of our variables of interest, namely $WAGE$ and $WAGE \times INCOME$, show a very clear pattern across different models in Table 5.4. The coefficient of $WAGE$ is always negative. The coefficient of $WAGE \times INCOME$ is always positive and is about 10 times smaller than that of $WAGE$. These results support our hypothesis that, in low-income countries, top managers of firms in high-wage industries find it more burdensome to deal with government regulation than top managers of firms in low-wage industries.

However, due to the interaction effects the marginal impact of $WAGE$ cannot be discerned directly from the magnitude of the two terms (Brambor et al., 2006). For this reason, we compute the marginal effect of $WAGE$ as:

$$\frac{\partial y_n^*}{\partial WAGE} = \beta_n + \delta_n \times INCOME$$

Next, the 95% confidence intervals of these marginal effects are computed. In Figure 5.1, we graph the marginal effects (together with their 95% confidence intervals) for the case of the top managers' perceptions on general corruption and the legal system. Similar figures for the perceptions related to labor regulation, business licensing and operating permits, and tax administration are included in Appendix 5.B. In all figures the marginal impact of WAGE on the respective dependent variable is on the vertical axis while the horizontal axis presents the level of income per capita.

Figure 5.1 suggests that top managers of firms in high-wage industries are more likely to perceive corruption and regulations as an obstacle to their firms' operations in low-income countries than in high-income countries. Consistent with the estimation results in Table 5.4, the marginal impact of $WAGE$ on each of the dependent variables is negative when the income level of the country is relatively low. The negative impact reduces and eventually becomes positive as the level of income per capita rises. The negative marginal impact of $WAGE$ is only significant when income per capita is lower than a certain threshold, which is explicitly noted in the top left of each graph. For example, the marginal impact of $WAGE$ on top managers' perception of corruption is only significant if income per capita is 8,602 dollars or lower. The corresponding income level for the perception of the extent to which the legal system is an obstacle is 12,785 dollars. The same pattern applies for perceptions related to labor regulation, business licensing and operating permits, and tax administration (see Appendix 5.B). The corresponding numbers for these cases are: 9,385 6,432; and 5,605 dollars.

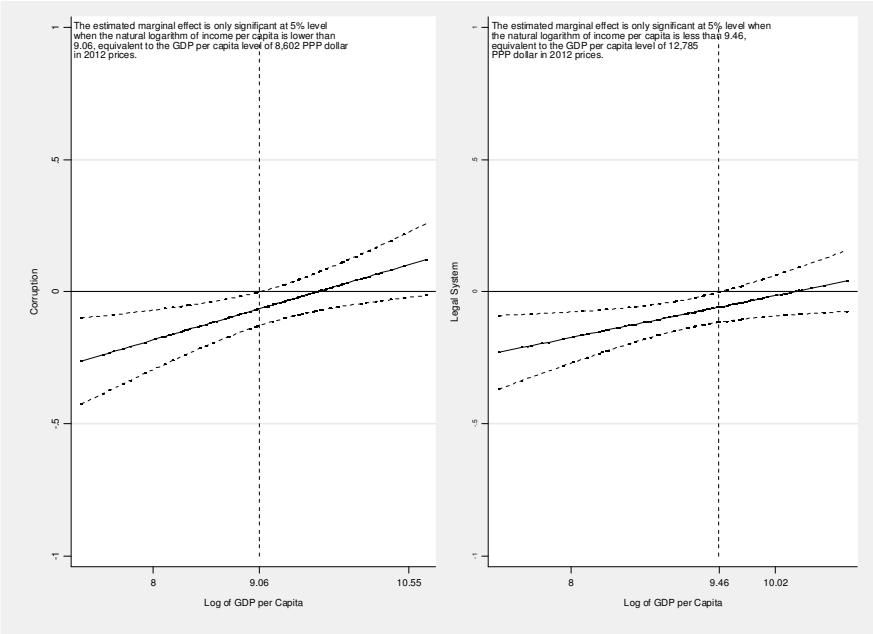

Figure 5.1. The marginal impact of inter-industry wage differentials on top managers' perception of corruption and red tape

There is no significant relationship between $WAGE$ and the top managers' perceptions of corruption and the legal system as an obstacle when the income level is higher than 8,602 and 12,785 dollars, respectively. This finding supports our expectation that high-wage firms are not targeted by corruptible bureaucrats in the richer countries, because corruptible bureaucrats in these countries do not have the incentive to harass the high-wage firms to extract petty bribes. Note, however, that the impacts of $WAGE$ on the perceptions of labor regulation, business licensing and operation permits, and tax administration are positive and significantly different from zero when the income level is higher than 22,584; 28,917; and 12,090 dollars, respectively. This finding is in line with our expectation that in relatively rich countries high-wage firms are more likely to be able to meet the costly government regulations. Therefore, top-managers of high-wage firms in relatively rich countries consider labor regulation, business licensing and operation permits, and tax administration less of an obstacle to their firms' operations than do top managers of low-wage firms (in the same country).

5.4.2 The relationship between inter-industry wage differentials and the actual costs of corruption and red tape

Table 5.5. The impact of inter-industry wage differentials on the top managers' reports on the costs of corruption and red tape

Dependent Variable	CORRUPTION COST		RED TAPE COST	
	LL=0	LL=0, UL=10.01	LL=0	LL=0, UL=50.01
(1)	(2)	(3)	(4)	(5)
WAGE	-4.46*	-3.10*	-14.39**	-12.40**
	(2.52)	(1.80)	(7.10)	(6.05)
WAGE x INCOME	0.44*	0.30	1.33*	1.15*
	(0.27)	(0.19)	(0.77)	(0.66)
FIRM AGE	-1.48***	-1.01***	0.66	0.70
	(0.51)	(0.29)	(0.69)	(0.58)
EXPORTER	0.24	0.15	0.79**	0.76***
	(0.22)	(0.15)	(0.34)	(0.29)
OWNERSHIP1	-0.74***	-0.56***	0.18	0.12
	(0.20)	(0.14)	(0.38)	(0.32)
OWNERSHIP2	-2.61***	-1.86***	0.18	0.40
	(0.66)	(0.46)	(0.60)	(0.54)
LEGAL1	0.13	0.12	-0.02	0.07
	(0.31)	(0.20)	(0.43)	(0.37)
LEGAL2	-0.17	-0.24	1.33**	1.11**
	(0.46)	(0.30)	(0.63)	(0.53)
LEGAL3	-0.51*	-0.28	-2.16***	-1.81***
	(0.30)	(0.21)	(0.55)	(0.47)
SMALL	1.34***	0.94***	-2.88***	-2.49***
	(0.37)	(0.25)	(0.73)	(0.62)
MEDIUM	0.96***	0.65***	0.02	0.07
	(0.28)	(0.18)	(0.39)	(0.35)
LOCATION1	0.17	0.17	0.70	0.66
	(0.46)	(0.32)	(0.64)	(0.56)
LOCATION2	0.53	0.44	-1.01**	-0.77*
	(0.55)	(0.39)	(0.48)	(0.42)
LOCATION3	0.74**	0.40*	-0.41	-0.21
	(0.34)	(0.22)	(0.57)	(0.48)
Constant	1.63***	2.34***	17.66***	16.66***
	(0.58)	(0.37)	(1.36)	(1.14)
Uncensored observations	7,952	7,604	27,055	27,055
Left-censored observations	20,348	20,348	13,527	12,436
Right-censored observations	0	348	0	991
No. of surveys	104	104	104	104
No. of Countries	52	52	52	52
Pseudo R-squared	0.07	0.08	0.03	0.04

Notes: this table presents the estimation of Equation (5.2) using the Tobit model. The name of the column is also the name of the dependent variable. The standard errors reported in the parentheses are corrected for within country-year clustered effects. 104 country-times-year dummies are included. *,**,*** indicate a significant level of 10%, 5% and 1%, respectively.

Table 5.5 presents the estimation results for Equation (5.2). Columns (2) and (3) are the estimates for the actual costs of corruption, while columns (4) and (5) present the estimates for the costs of red tape. Following Alexeev and Song (2013), we first estimate the models when we only put a lower limit of zero to the dependent variables. Next, we impose some upper limit to both dependent variables because some top managers report unusually high costs. For example, most respondents report that their firms spend less than 10% of annual sales on corruption, but few respondents report a (sometimes much) higher percentage,

even up to 100% of annual sales. The same is true for the reported costs of red tape. Most managers indicate that they spend less than 50% of their time on dealing with government regulations. Observations with unusually high numbers can be influential and may distort the estimation results. For this reason, we impose an upper limit of 10.01% for the costs of corruption (column 3) and 50.01% for the costs of red tape (column 5).

The findings reported in Table 5.5 are similar to those of Table 5.4. The coefficient of $WAGE$ is negative while the coefficient of $WAGE \times INCOME$ is postive, and about 10 times smaller in magnitude. The coefficient of $WAGE$ is significant at the 10% level when the dependent variable is corruption costs and significant at the 5% level in the case of red tape. The coefficient of $WAGE \times INCOME$ is significant at the 10% level in three out of four regressions. When the upper limit is imposed, both coefficients become smaller, supporting our argument that it is necessary to correct for the cases of unusually high reported costs of corruption and red tape.

The results in Table 5.5 indicate that the impact of $WAGE$ is moderated by income per capita. From Equation (5.2), the marginal impact of $WAGE$ on $Corruption\ cost$ and $Red\ tape\ cost$ can be computed as:

$$\frac{\partial y_m^*}{\partial WAGE} = \beta_m + \delta_m \times INCOME$$

Again, we compute the marginal impacts and their 95% confidence intervals for the models in columns (3) and (5) of Table 5.5 and graph the results in Figure 5.2. As before, the vertical axis represents the impact of $WAGE$ on the costs of corruption and red tape when $WAGE$ increases by one unit. The horizontal axis shows the level of income per capita. Figure 5.2 shows that the marginal impact of $WAGE$ on firms' corruption expenditure is negative and significant at the 5% level when income per capita is about 6,121 dollars or lower. Above this income level, no significant result can be established. The corresponding number in the case of red tape is 14,744 dollars.

The results show that managers of high-wage firms spend more time on dealing with the government and also to pay a larger amount "to get things done". However, the effects are statistically significant in low-income countries only. With respect to the size of the effects, take, for example, two industries in a country with an income level of about 3,000 dollars (equivalent to 8 in natural logs). In the case of corruption in column (3), we have that $\partial y_m^*/\partial WAGE = -0.7$. If the wage level of one industry is about 10% higher than the wage level of the other industry, firms in the former have to pay an extra amount of about 0.07% of their annual sales on corruption. At the same time, their senior managers spend about 0.35% more of their time on dealing with government regulations.

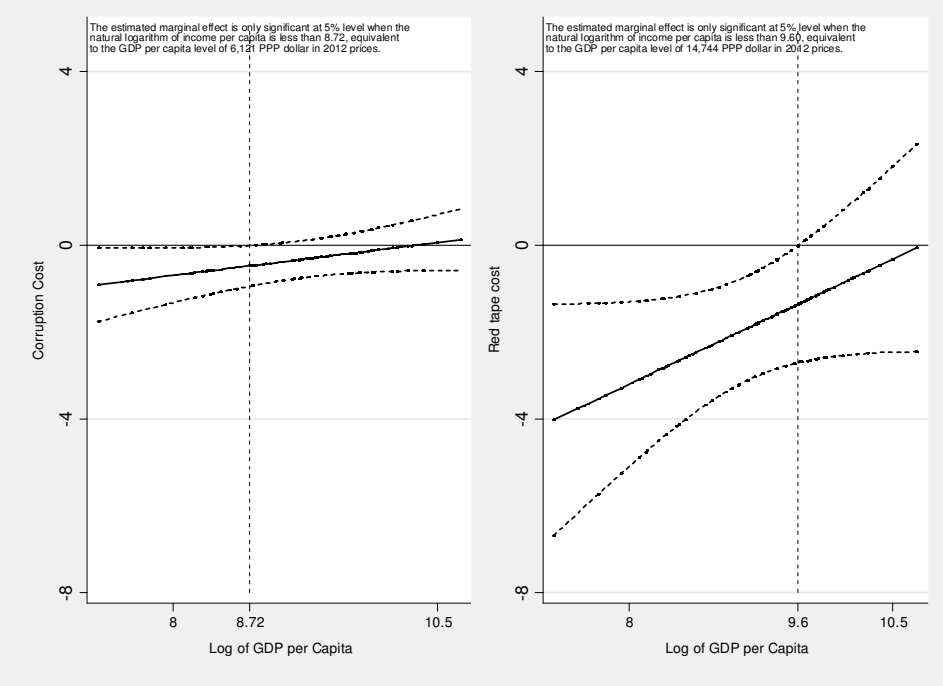

Figure 5.2. The marginal impact of inter-industry wage differentials on top managers' reports on the costs of corruption and red tape

5.4.3 The impact of other variables

A general pattern across the models in Tables 5.4 and 5.5 is that firm age, government ownership and foreign ownership are associated with less negative perceptions of corruption and government regulations, and lower spending on corruption. In comparison with large firms, small and medium-sized firms have less negative perceptions of corruption and red tape but they have to pay a significantly larger amount of annual sales on corruption. The variables on the firms' legal status appear to be less significant determinants of corruption perceptions, time spent on red tape, and corruption expenditures. Only firms with the sole propriety legal status report better perception of government regulations, spend less time on dealing with government regulations and, to some extent, pay less bribes.

There is strong evidence that firms located in capital cities pay more bribes and have worse perceptions of corruption and government red tape. Finally, exporting firms report mixed results on corruption and regulation perceptions, red tape cost and bribery expenditure. There is no evidence that these firms pay more bribes or have worse perceptions of general corruption. However, they appear to have worse perceptions of government regulations and

spend more time on dealing with government regulations. Perhaps, this is because exporting firms have to deal with these aspects of the government more frequently.

5.4.4 Robustness checks

Our results thus far indicate that managers of firms in high-wage industries in low-income countries have worse perceptions of corruption and government regulations as obstacles to run their firms, spend more time on dealing with government regulations, and pay a larger share of annual sales on corruption. The results in Tables 5.4 and 5.5 thus lend support to our hypothesis that corrupt government officials in low-income countries use wage differentials as an indicator to target firms to extract bribes.

However, one alternative explanation to this finding might be that high-wage industries are highly concentrated industries. According to Alexeev and Song (2013), corruption happens when corruptible government bureaucrats collude with firms to share the rent. When concentration is high and competition for public services is low, firms have to spend less on bribery. However, when concentration is low and competition is high, more firms compete for public services and they have to spend more on bribery (Alexeev and Song, 2013).

Following Alexeev and Song (2013) we compute the Herfindahl-Hirschman index (HHI), which is a conventional measure of industry concentration and has been used frequently to measure competition at the industry level.[10] This index is defined as the sum of squares of the ratio of the respondent firm's sales to total sales in the respondent firm's industry. To reflect market power of firms, it is better to define the industries at a finer level than the ISIC 3 one-digit level. For this reason, the HHI is calculated for the ISIC 3 two-digit level industries. Higher values of the HHI are associated with more concentration, and thus weaker competition.

We estimate the models in Equation (5.1) and add HHI into X_{nijkt}. The results are reported in Table 5.6. The results suggest that our findings are not affected by the inclusion of HHI. All coefficients, including those of $WAGE$ and $WAGE \times INCOME$, remain almost the same. The coefficient of HHI is only negative and significantly different from zero when perception on labor regulations is the dependent variable. In the other models the coefficient of HHI is not significantly different from zero at conventional levels.

[10] Some authors have argued that the Herfindahl-Hirschman index may not be a good measure of competition (see, for instance, Bikker and Haaf, 2002). We have therefore also used markups as an alternative measure of competition. In that case, the main results of our models as well as our empirical conclusions remain unchanged. However, the number of observations drops by almost 50% to missing data in sales and operating costs, which are necessary to compute the markups. The results are available on request.

Table 5.6. The impact of inter-industry wage differentials on the top managers' perception of corruption and red tape with industry concentration as additional control variable

Depedent Variables	MAJOR OBSTACLE TO FIRMS' OPERATION				
	Corruption	Legal System	Labor Regulation	Operating License	Tax Administration
(1)	(2)	(3)	(4)	(5)	(6)
WAGE	-1.08***	-0.81**	-1.63***	-1.24***	-1.41***
	(0.37)	(0.32)	(0.38)	(0.46)	(0.26)
WAGE x INCOME	0.11***	0.08**	0.17***	0.13***	0.15***
	(0.04)	(0.03)	(0.04)	(0.05)	(0.03)
FIRM AGE	-0.06	0.07*	0.02	-0.13***	-0.04
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
EXPORTER	0.02	0.05***	0.08***	0.04**	0.07***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
OWNERSHIP1	-0.05**	-0.02	-0.03	0.03	-0.05**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
OWNERSHIP2	-0.22***	-0.17***	-0.11**	-0.21***	-0.25***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)
LEGAL1	0.02	0.00	-0.01	0.01	0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
LEGAL2	-0.01	0.02	-0.06*	0.01	0.00
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LEGAL3	-0.03	-0.08***	-0.06**	-0.04**	-0.01
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
SMALL	0.06**	-0.09***	-0.25***	-0.08***	-0.03
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
MEDIUM	0.07***	-0.01	-0.07***	-0.03*	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
LOCATION1	0.04	0.01	0.02	0.02	0.04
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
LOCATION2	-0.00	0.01	-0.01	0.07	0.03
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
LOCATION3	0.10***	0.08***	0.01	0.07***	0.05**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
HHI	0.01	0.02	-0.04**	0.02	0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	41,184	39,470	42,842	41,913	42,639
No. of surveys	104	104	104	104	104
No. of countries	52	52	52	52	52
Pseudo R-squared	0.08	0.07	0.09	0.04	0.08

Notes: this table presents the estimation of equation (5.1) with the HHI index as an additional control variable, using the Ordered Probit model. The name of the column is also the name of the dependent variable. The standard errors reported in the parentheses are corrected for country-year clustered effects. 104 country-times-year dummies are included. *,**,*** indicate a significant level of 10%, 5% and 1%, respectively.

Next, we estimate Equation (5.2) and add HHI into X_{mijkt}. The results are reported in Table 5.7. Again, our estimation results remain largely the same when HHI is included in the model, except for a small increase in the coefficients for $WAGE$. This also causes the marginal impact of $WAGE$ on the cost of corruption to become less negative. As a consequence, the level of income per capita below which the marginal effect is significant (see Figure 5.2) at the 10% level is 5,047 dollars. For the case of the cost of red tape, the marginal impact of $WAGE$ is significant at the 5% level for per capita incomes of 16,069 dollars or lower. The coefficient of HHI is negative in both cases, but is only significantly different from zero in the regression for the actual cost of corruption.

Table 5.7. The impact of inter-industry wage differentials on the top managers' reports on the costs of corruption and red tape with industry concentration as additional control variable

INDEPENDENT VARIABLES	CORRUPTION COST		RED TAPE COST	
	LL = 0, UL = 10.1		LL =0, UL = 50.1	
	Estimates	Standard Errors	Estimates	Standard Errors
(1)	(4)	(5)	(2)	(3)
WAGE	-2.87*	(1.68)	-12.31**	(5.98)
WAGE x INCOME	0.29	(0.18)	1.15*	(0.65)
FIRM AGE	-1.02***	(0.29)	0.69	(0.58)
EXPORTER	0.11	(0.14)	0.73**	(0.29)
OWNERSHIP1	-0.55***	(0.14)	0.12	(0.32)
OWNERSHIP2	-1.88***	(0.46)	0.39	(0.54)
LEGAL1	0.11	(0.20)	0.07	(0.37)
LEGAL2	-0.24	(0.30)	1.10**	(0.53)
LEGAL3	-0.28	(0.21)	-1.82***	(0.47)
SMALL	0.96***	(0.25)	-2.48***	(0.63)
MEDIUM	0.65***	(0.18)	0.08	(0.35)
LOCATION1	0.17	(0.32)	0.67	(0.56)
LOCATION2	0.44	(0.39)	-0.78*	(0.42)
LOCATION3	0.41*	(0.22)	-0.20	(0.48)
HHI	-0.53**	(0.21)	-0.31	(0.37)
Constant	2.44***	(0.38)	16.69***	(1.54)
Uncensored observations	7,604		27,065	
Left-censored observations	20,348		12,436	
Right-censored observations	348		991	
No. of surveys	104		104	
No. of Countries	52		52	
Pseudo R-squared	0.11		0.04	

Notes: This table presents the estimation of equation (5.2) with the HHI index as an additional control variable. The name of the column is also the name of the depdendent variable. The standard errors reported in the parentheses are corrected for within country-year clustered effects. *,**,*** indicate a significant level of 10%, 5% and 1%, respectively.

5.5 Conclusion

In this chapter we have used a large sample of firms from all over the world to examine the relationship between inter-industry wage differentials and corruption and red tape. Corruptible bureaucrats in relatively low-income countries may not have precise information about firms' ability to pay bribes. Therefore, they may use information on the average wage level of the industry in which the firm operates as an indicator, and 'rattle' firms in high-wage industries by more burdensome red tape to extract petty bribes. For this reason, firms in high-wage industries in poor countries may have worse perceptions of government corruption and government regulations, suffer from more red tape, and spend more on bribery. Although the inter-industry wage structure is relatively stable across countries (and over time), high-wage firms in relatively rich countries may not suffer from such discrimination. This is because petty corruption is not common in countries with relatively high-income levels and firms may have enough financial resources to meet costly government regulations.

Based on a sample of 43,568 firms and controlling for country as well as firm characteristics, we find significant evidence that firms from high-wage industries in relatively poor countries complain more about red tape and corruption. This supports our hypothesis that corruptible bureaucrats in low-income countries use information on inter-industry wage differentials as an indicator of the possibility of extracting bribes.

We find similar results for the relationship between inter-industry wage differentials and the reported amount of money spent on corruption (measured as the percentage of annual sales spent on bribes) and the cost of red tape (measured as the percentage of senior management time spent on government regulation). When income per capita is less than 6,121 dollars, firms in industries with a higher average wage have to pay more gifts and informal payments "to get things done". When income is less than 12,785 dollars, senior management in industries with a higher average wage spends a significantly larger share of their time on dealing with government regulations.

Our findings on the relationship between inter-industry wage differentials, corruption and red tape are robust, even when we control for the possible alternative explanation of the variation in the top managers' perception of corruption, such as the level of concentration at the ISIC 3 2-digit industry level.

Our findings shed new light on the nature of corruption in developing countries. Anti-corruption policy should take account of the fact that—for the extraction of bribes—corruptible bureaucrats discriminate firms according to average wage level of the firm's industry. Monitoring, detection and punishment of corruption should be focused on bureaucrats responsible for regulating high-wage industries.

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5.7 Appendices

5.7.1 Appendices 5.A. List of countries and years included in this chapter

Country	Year	Number of firms	Country	Year	Number of firms
Albania	2002	136	Kyrgyzstan	2002	172
Albania	2005	166	Kyrgyzstan	2003	102
Argentina	2010	1042	Kyrgyzstan	2005	202
Armenia	2002	170	Latvia	2002	172
Armenia	2005	351	Latvia	2005	205
Armenia	2009	369	Latvia	2009	269
Azerbijan	2002	170	Lithuania	2002	199
Azerbijan	2005	349	Lithuania	2004	229
Azerbijan	2009	350	Lithuania	2005	205
Bosnia & Herzgovina	2002	145	Lithuania	2009	269
Brazil	2003	1634	Macedonia	2002	170
Brazil	2009	1113	Macedonia	2005	200
Bulgaria	2002	247	Macedonia	2009	351
Bulgaria	2004	517	Mauritius	2009	353
Bulgaria	2005	300	Moldova	2002	174
Bulgaria	2007	1015	Moldova	2003	103
Bulgaria	2009	270	Moldova	2005	350
Chile	2010	1027	Moldova	2009	362
China	2002	1442	Mongolia	2009	359
Colombia	2010	900	Montenegro	2009	115
Costa Rica	2005	338	Nicaragua	2010	287
Costa Rica	2010	514	Panama	2010	346
Croatia	2002	176	Paraguay	2010	359
Croatia	2005	232	Peru	2010	991
Croatia	2007	520	Philippines	2009	1293
Czech Republic	2002	264	Poland	2002	497
Czech Republic	2005	338	Poland	2003	108
Czech Republic	2009	215	Poland	2005	974
Dominican Republic	2005	109	Poland	2009	385
Dominican Republic	2010	341	Portugal	2005	503
Ecuador	2010	352	Romania	2002	254
El Salvadar	2003	175	Romania	2005	600
El Salvadar	2010	328	Romania	2009	491
Estonia	2002	169	Russian Federation	2005	600
Estonia	2005	219	Russian Federation	2009	975
Estonia	2009	270	Serbia	2002	182
Georgia	2002	174	Serbia	2005	300
Georgia	2005	200	Serbia	2009	384
Georgia	2008	365	Slovakia	2002	162
Germany	2005	1186	Slovakia	2005	215
Greece	2005	541	Slovakia	2009	236
Guatemala	2003	109	Slovenia	2002	186
Honduras	2003	163	Slovenia	2005	221
Honduras	2010	320	Slovenia	2009	272
Hungary	2002	247	South Africa	2003	182
Hungary	2005	608	South Africa	2007	874
Hungary	2009	288	Spain	2005	601
Indonesia	2009	1387	Tajikistan	2003	106
Ireland	2005	491	Ukraine	2002	453
Kazakhstan	2002	247	Ukraine	2005	593
Kazakhstan	2005	585	Ukraine	2008	801
Kazakhstan	2009	531	Uruguay	2010	569
			Venezuela	2010	292

5.7.2 Appendix 5.B

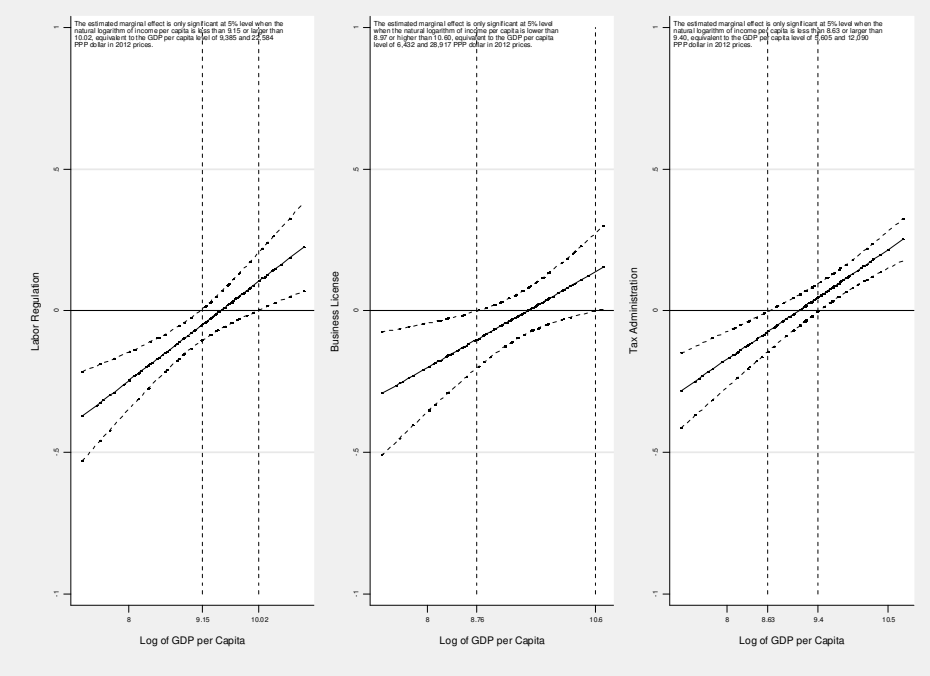

Figure 5.3. Marginal impact of WAGE on the top managers' perception of labor regulation, business licensing and operation permits, and tax administration.

Chapter 6
Conclusions

6.1 Main findings

Two research questions have been addressed in this thesis:

- First, how can a reliable dataset on government wages that covers a large number of countries over a reasonably long period of time be collected to facilitate further empirical research on the relationship between government wages and corruption?
- Second, what is the impact of government wages on corruption?

By addressing these questions, the thesis makes four contributions to the literature. First**,** it proposes a new approach to measure wages at the aggregate level using micro survey data. Second, it introduces a new worldwide database on wages to facilitate future research on economic issues related to wages at the ISIC 3 industry level. Third, it demonstrates that government wages imputed from the government wage bill and government employment are unreliable. Fourth, it sheds new light on the mechanisms through which government wages influence corruption. Raising government wages only reduces corruption at a relatively low level of income per capita. Also, in relatively poor countries corrupt bureaucrats target firms in high-wage industries to extract petty bribes.

6.1.1 A new dataset

Defining industrial wages as the average nominal wages and salaries of all employees working in an industry, Chapter 2 introduces a micro-based database of wages for 17 ISIC 3 one-digit industries and for the whole economy. The database covers a large number of developing—next to developed—countries. It thus makes it possible to extend analyses to countries which have so far been neglected due to the lack of data. The database consists of 4 datasets. The first three datasets contain data collected by the ILO and SEDLAC, and the original micro survey datasets which were collected from 6 international databases and several national archives. The fourth dataset combines these three datasets into a unified dataset. This unified dataset covers 126 countries over a period of about 12 years with 1,488 observations. As more survey data will become available, the database will be updated regularly in the future.

Although the concepts of wages, time basis and worker coverage vary from one country to another, the database is suitable for studying relative wages between industries within the same country and between countries. This is because the concepts of wages, time basis and worker coverage are consistent for each country-year. Therefore, analyses based on relative wages are not likely to suffer from any loss of precision. Authors who are interested in comparing the levels of industry wages between countries or analyzing the trend of wages over time should consult the explanatory notes as well as the flag variables which are provided in the database to ensure that data are comparable across countries and over time.

6.1.2 A new approach to measure wages at the aggregate level

Chapter 3 shows that the macro data approach to calculate average government wages—by dividing the government wage bill by government employment—is unreliable. The micro data approach estimates government wages as the weighted mean of wages in a random and representative sample of government employees. This mean yields an unbiased estimate of the true population average government wage. Both macro-based and micro-based government wages were estimated for 20 countries, using data from the OECD STAN database and a large number of high-quality household survey micro datasets from the EU-SILC database. The two wages are compared and the outcomes show serious discrepancies between the micro and macro results. Given the unbiasedness of the micro wages, this indicates that government wages computed from macro data sources are biased.

For some countries, the macro government wages are lower than the micro wages while the opposite is true for other countries. Only in a few countries are the macro government wages in line with the micro wages. The bias varies from one country to another but appears to be relatively constant over time within each country. Similar findings also hold for other ISIC 3 industries. It is also found in Chapter 3 that the bias is not only caused by inappropriately measuring employment, suggesting that there are also errors in the data for the government wage bill. Because the macro data approach has been widely applied in empirical research, this may have important consequences for the results. Future research should adopt the micro data approach in measuring not only government wages but also wages at other aggregate levels such as the ISIC 3 industries.

6.1.3 The impact of higher government wages on corruption

Using the fixed effects econometric model and a sample of 76 countries with 898 observations over the late 1980s – 2010 period, Chapter 4 finds that the impact of government wages on corruption is moderated by the level of per capita income. When income per capita is relatively low, an increase in government wages reduces corruption. This negative impact becomes smaller when the level of income increases, and eventually becomes positive (though insignificant). These results are robust, even when an alternative (micro-based) measure of corruption is employed. The impact of government wages on corruption remains also significant when the lags of the government wage indicator are used in order to deal with possible reversed causality. Likewise, using latitude instead of income to deal with multicollinearity problems does not change the main results.

Intuitively, petty corruption is more prevalent in poor countries, and well-paid bureaucrats forgo such type of corruption. However, when incomes in a country are higher, petty corruption becomes less important. Grand corruption, involving more secret transactions that violate the laws and regulations, becomes prevalent. This type of corruption brings about larger revenues that outweigh any realistic compensation package to the corrupted bureaucrats. It is also more difficult to detect. To combat the latter form of corruption, increasing government wages might not be efficient.

6.1.4 The relationship between inter-industry wage differentials and corruption

Based on a sample of 43,568 firms from all over the world and non-linear Ordered Probit and Tobit econometric models, Chapter 5 presents evidence that firms in high-wage industries in relatively poor countries complain more about red tape and corruption. It also shows similar results for the relationship between inter-industry wage differentials and the reported amount of money spent on corruption (measured as the percentage of annual sales spent on bribes) and the cost of red tape (measured as the percentage of senior management time spent on government regulations). When income per capita is less than 6,121 dollars, firms in high-wage industries have to make more informal payments "to get things done" than firms in industries with a lower wage. When income is less than 12,785 dollars, senior management of firms in high-wage industries spends a significantly larger share of their time on dealing with government regulations than that of firms in industries with a lower wage. These results are robust even when we control for industry concentration (or competition) as an alternative explanation.

Corruptible bureaucrats in relatively low-income countries may not have precise information about firms' ability to pay bribes. However, they may use the information on the wage level of the industry in which the firm operates as an indicator, and 'rattle' high-wage firms by more burdensome red tape to extract petty bribes. For this reason, firms in high-wage industries in poor countries have worse perceptions of government corruption and government regulations, suffer from more red tape, and spend more on bribery. Although the inter-industry wage structure is relatively stable across countries (and over time), high-wage firms in relatively rich countries do not suffer from such discrimination. This is because petty corruption is not common at relatively high-income levels and these firms may have enough financial resources to meet costly government regulations.

6.2 Policy implications

Several policy implications can be drawn from the finding on the relationship between higher government wages and corruption in Chapter 4. Higher government wages only reduce corruption in low-income countries. Government wages may not be an efficient policy tool to reduce corruption in upper middle- or high-income countries with a relatively high level of corruption, such as Greece and Italy. In low-income countries, increasing wages may substantially reduce corruption.

An increase in average government wages with an amount that equals the average wages in manufacturing leads to a decrease of about one point in corruption (measured on a 0 to 6 scale) for countries with an income level between $1000 and $2000 (in 2012 prices). This drastic pay rise, which, in many cases, is equivalent to doubling the government wages, seems to be unrealistic. However, this is what happened in successful anti-corruption examples such as Singapore, Hong Kong and, more recently, Da Nang, a city in central

Vietnam.[1] A more recent example is Georgia (the former Soviet Republic). Government wages relative to the wages in manufacturing in this country increased from 0.87 in 2003 to 1.70 in 2008. At the moment of writing this conclusion, Georgia is being praised as a successful example of combatting corruption.[2]

A reduction of corruption in combination with other policy reforms can improve the investment climate substantially, moving a country to a new equilibrium with less corruption and more productive economic activities. Such a scenario is in contrast with theoretical studies arguing that governments in highly corrupted countries should pay low wages and maintain a corrupt bureaucracy (Besley and McLaren, 1993; Chang and Lai, 2002). The results of in this chapter suggest that higher government wages might be used to combat corruption in the poorest and most corrupted countries.

The findings in Chapter 5 shed new light on the nature of corruption in developing countries. Anti-corruption policy should take into account the fact that corruptible bureaucrats discriminate firms according to the industry's average wage level in order to extract bribes. Firms in high-wage industries, therefore, face more red tape and spend more on corruption. Monitoring, detection and punishment of corruption should be focused on bureaucrats responsible for regulating high-wage industries. Combining the finding of Chapters 4 and 5, increasing government wages for bureaucrats regulating high-wage industries, it should be taken into consideration that there are possibly more corruptible government officials regulating high-wage industries than other industries. When using wage measures is too costly, it may be more efficient to selectively raise government wages in areas where the incentives to become corrupt are strong.

6.3 Limitations and implications for future research

The impact of government wages on corruption may be much stronger if wage policies are accompanied by complementary measures. In other words, reducing corruption by one point in a 1,000-dollar-per-capita country may require a pay rise less than the average wages in manufacturing if this measure is taken in the context of a comprehensive strategy against corruption. Successful examples against corruption often combine higher government wages with other reform measures or strong monitoring mechanisms. The Independent Commission against Corruption in Hong Kong and the Anti-Corruption Agency in Singapore are examples of powerful and effective anti-corruption agencies. Future research may shed more light on this issue by studying in more detail successful anticorruption strategies.

Some authors argue that not only low average government wages but also wage compression may lead to corruption (Klitgaard, 1989; Ul Haque and Aziz, 1999; Ul Haque,

[1] Detailed information is given on the Vietnamese website http://vnexpress.net/gl/xa-hoi/2012/03/da-nang-ho-tro-csgt-5-trieu-dong-moi-thang/. The city authority decided to pay an extra 5 million VND per month to each policeman to stop traffic bribery. This pay rise was then equivalent to approximately twice the average manufacturing wages in Vietnam. However, it applied only to a small fraction of government employees, i.e. traffic police.

[2] http://www.economist.com/blogs/easternapproaches/2012/02/tbilisi%E2%80%99s-corruption-busters

2007). Wage compression implies flat salary scales between lower and upper levels of government employees. There are almost no wage premiums to high level government employees who have the most opportunities to corrupt. This compression results in brain drain, inefficiency, moonlighting, demoralization, and especially corruption. The business of government shifts from development to predation (Klitgaard, 1989).

Therefore, future research should focus also on the impact of wage compression on corruption. It may also be interesting to consider the interaction between higher government wages and the degree of wage compression. For example, are higher government wages more effective in combatting corruption if the wage differentials between senior government officials and low skill government employees are higher?

Finally, focusing on ISIC 3 one-digit level industries ensures that the database in Chapter 3 and the subsequent analyses in Chapters 4 and 5 can be extended to a larger number of countries. However, it can also be more efficient to consider the impact of inter-industry wage differentials on corruption in Chapter 5 at finer levels, such as the ISIC 3 two-digit industries.

Together with including more countries as more micro data become available, future versions of the database will also provide data at ISIC 3 two-digit level and wage compression measures for a number of countries with data of sufficient quality.

6.4 References

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Samenvatting (summary in Dutch)

Corruptie wordt gedefinieerd als “het misbruiken van een openbaar ambt voor eigen gewin” of “een daad, waarin een openbaar ambt wordt gebruikt voor persoonlijk gewin op een manier die in strijd is met de spelregels”. Corruptie wordt vaak gelijkgesteld aan omkoping die ontstaat wanneer werknemers bij de overheid – met een zekere discretionaire bevoegdheid om schaarse publieke goederen naar andere agenten te distribueren of om hen kostbare regels op te leggen – betaling voor bepaalde gunsten vragen. Corruptie omvat echter ook een breed scala van andere illegale misdragingen zoals verduistering (het stelen van publieke middelen), fraude (het misbruiken van een openbaar ambt om mensen te bedriegen om zo geld te verdienen), zelfverrijking (het misbruiken van een openbaar ambt om transacties te organiseren om persoonlijk van te profiteren), vriendjespolitiek (het oneerlijk bevoordelen van een persoon of groep ten koste van een ander) en nepotisme (het begunstigen van familieleden).

Economisch onderzoek naar corruptie wordt gekenmerkt door een aantal fasen. Corruptie werd aanvankelijk gezien als een principaal-agentprobleem en onderzoek was gericht op een positieve analyse van mechanismen die het probleem veroorzaken. Sommige auteurs beweerden dat corruptie slecht is en suggereerden correctiemaatregelen, terwijl anderen een toleranter standpunt innamen en betoogden dat corruptie niet per se strijdig met economische ontwikkeling hoeft te zijn. Corruptie werd echter als een van de ernstigste groeibelemmeringen gezien naarmate economische ontwikkeling een belangrijker beleidsterrein werd. Onderzoek naar corruptie is sindsdien sterk gegroeid. Inmiddels worden meer dan 70 factoren genoemd als mogelijk oorzaken van corruptie. Nieuwe inzichten in de oorzaken en de gevolgen van het probleem zijn blootgelegd.

Onderzoeksvragen

Dit proefschrift draagt bij aan de literatuur door de invloed van het beloningsbeleid van ambtenaren op corruptie te bestuderen. Het onderwerp is de afgelopen decennia al in een groot aantal studies onderzocht. De meeste overheden zijn nog steeds terughoudend in het toepassen van dit beloningsbeleid ter bestrijding van corruptie, mogelijkerwijs omdat wetenschappelijk onderzoek tot nu toe geen sluitend bewijs over de effectiviteit van dit instrument aan heeft kunnen tonen. Twee onderzoeksvragen zijn in dit proefschrift aan de orde:

• Ten eerste: hoe kan een betrouwbare dataset worden samengesteld waarin ambtelijke lonen voor een groot aantal landen en een redelijk lange periode zijn opgenomen teneinde empirisch onderzoek naar het verband tussen ambtelijke lonen en corruptie te faciliteren?

• Ten tweede, wat is de impact van ambtelijke lonen op corruptie ?

Waar de literatuur doorgaans ambtelijke lonen met macrodata berekent, hanteert dit proefschrift een bottom-up-strategie op basis van micro-enquêtes. Deze micro-enquêtes zijn representatief op landenniveau en worden vaak jaarlijks uitgevoerd door de nationale statistische bureaus. Deze onderzoeken maken deel uit van de belangrijkste

informatiebronnen voor sociaaleconomische zaken in zowel ontwikkelde als ontwikkelingslanden. Data uit micro-enquêtes worden steeds belangrijker in sociaalwetenschappelijk onderzoek en beleidsanalyses. Vrijwel alle landen hebben enquêtes op het gebied van werk en inkomen gehouden. Hierdoor is het steeds beter mogelijk om microdata voor een groot aantal ontwikkelings- en ontwikkelde landen te verzamelen.

Bevindingen

Hoofdstuk 2 geeft een uiteenzetting van een nieuwe database van loongegevens met 1488 observaties voor 126 landen en een periode van gemiddeld 12 jaar. Ondanks conceptuele verschillen is het mogelijk om met deze database relatieve lonen tussen industrieën zowel binnen een land als tussen meerdere landen te analyseren. Dit komt doordat er grote zorg is besteed aan het consistent maken van loongegevens, de frequentie waarop deze gegevens gemeten worden en de dekkingsgraad. Hierdoor is het mogelijk relatieve lonen te analyseren zonder dat dit ten koste gaat van precisie.

Met behulp van deze meer betrouwbare en nieuwe database worden mogelijke tekortkomingen blootgelegd van overheidslonen die op basis van macro-gegevens zijn samengesteld. Hoofdstuk 3 toont aan dat de macro-databenadering om de gemiddelde ambtelijke lonen te berekenen – namelijk het totaal aan ambtelijke lonen delen door het aantal ambtenaren – onbetrouwbaar is. Met de micro-databenadering worden ambtelijke lonen geschat op basis van gewogen gemiddelden van lonen in een willekeurige en representatieve steekproef van ambtenaren. Dit gemiddelde geeft een zuivere schatting van het ware populatiegemiddelde. Zowel de macro- als de microbenadering zijn toegepast om ambtelijke lonen van 20 landen te schatten. Hiervoor is gebruik gemaakt van gegevens uit de OECD STAN database en een groot aantal huishoudelijke micro-enquêtes van hoge kwaliteit uit de EU-SILC database. De uitkomsten van beide benaderingen worden naast elkaar gelegd en substantiële verschillen worden aangetoond. Ambtelijke lonen berekend op basis van de macrobenadering zijn, gegeven de zuivere schattingen met de micro-benadering en de grote verschillen tussen de micro- en macro-methoden, onbetrouwbaar.

Vervolgens wordt de nieuwe database gebruikt om het effect van ambtelijke lonen op corruptie te onderzoeken, zowel op landen- als op bedrijfsniveau. In hoofdstuk 4 wordt gebruikt gemaakt van een econometrisch model met fixed effects en een steekproef van 76 landen met 898 waarnemingen voor de periode tussen de late jaren 1980 en 2010. Er wordt aangetoond dat het effect van ambtelijke lonen op corruptie gemodereerd wordt door het inkomen per capita. Als het inkomen per capita relatief laag is, leidt een toename van ambtelijke lonen tot minder corruptie. Dit negatieve effect wordt kleiner naarmate het inkomensniveau stijgt en is zelfs positief (maar niet significant) voor een hoog inkomensniveau. De bevindingen zijn robuust, zelfs wanneer er gebruik wordt gemaakt van een alternatieve (micro) maatstaf van corruptie. Het effect van ambtelijke lonen op corruptie blijft ook significant wanneer er rekening wordt gehouden met mogelijke endogeniteit. De bevindingen veranderen ook niet wanneer latitude in plaats van inkomen wordt gebruikt om problemen met multicollineariteit tegen te gaan.

De intuïtie is dat onbeduidende corruptie (*petty corruption*) gangbaarder is in arme landen en dat goedbetaalde ambtenaren hiervan afzien. Naarmate het inkomensniveau stijgt, neemt corruptie echter ook een meer omvangrijke vorm aan (*grand corruption*) waarin er sprake is van geheime en onwettige transacties. Deze vorm van corruptie leidt tot opbrengsten

waartegen, in de ogen van de corrupte ambtenaar, een hoger salaris niet opwegen. Grand corruption is ook moeilijker om op te sporen. Het verhogen van ambtelijke lonen is dan geen efficiënte maatregel om deze vorm van corruptie tegen te gaan.

Tot slot verkent hoofdstuk 5 het effect van loonverschillen tussen industrieën op bureaucratische rompslomp en corruptie. Er wordt gebruik gemaakt van een steekproef van 43568 bedrijven vanuit de hele wereld en non-lineaire Ordered Probit en Tobit modellen. Bij een inkomen per capita van minder dan 6121 dollar moeten bedrijven in bedrijfstakken met hoge lonen meer informele betalingen verrichten om "zaken gedaan te krijgen" dan bedrijfstakken waarin het loon lager is. Bij inkomens lager dan 12785 dollar besteden managers van bedrijven in bedrijfstakken met hoge lonen significant meer tijd aan regelgeving dan bedrijven in bedrijfstakken met lage lonen. Een alternatieve verklaring heeft te maken met de mate van concurrentie binnen of concentratie van een bedrijfstak, maar de bevindingen blijven hetzelfde.

Corrumpeerbare ambtenaren in landen met een relatief laag inkomen beschikken wellicht niet over exacte informatie over de mate waarin een bedrijf in staat is om smeergeld te betalen. Het is echter wel mogelijk dat zij informatie over de hoogte van lonen in de bedrijfstakken als een indicator gebruiken om hun doelwit te kiezen, waardoor bedrijven met hoge lonen vaker met bureaucratische rompslomp geconfronteerd worden en smeergeld moeten betalen. Om deze reden hebben bedrijven in bedrijfstakken met hoge lonen in arme landen een slechtere perceptie van publieke corruptie en regelgeving, hebben zij meer last van bureaucratische rompslomp en wordt meer smeergeld betaald. Hoewel de lonenstructuur tussen bedrijfstakken over de jaren en tussen landen vrij stabiel is gebleven, hebben bedrijven uit bedrijfstakken met hoge lonen in landen met een hoog inkomen geen last van deze vorm van discriminatie. Dit komt doordat petty corruption in deze landen niet gebruikelijk is en deze bedrijven mogelijk voldoende financiële middelen hebben om aan kostbare regelgeving te voldoen.

Naast het leveren van nieuw empirisch bewijs ten aanzien van het effect van lonen op corruptie, biedt dit proefschrift een goede database voor verder onderzoek naar dit onderwerp. Deze database zal in de toekomst worden bijgewerkt als meer gegevens uit micro-enquêtes beschikbaar worden gesteld.